ES:GCP/INT/619/EC
Technical Report

WINDISP 4.0

Multilingual Version

Map and Image Display and Analysis Software

Developed by Eric Pfirman, Justin Hogue and Linda See
SEDI routines developed by Peter Hoefsloot
for the
FAO Global Information and Early Warning System

USER'S MANUAL

Developed by Isabelle Charlier
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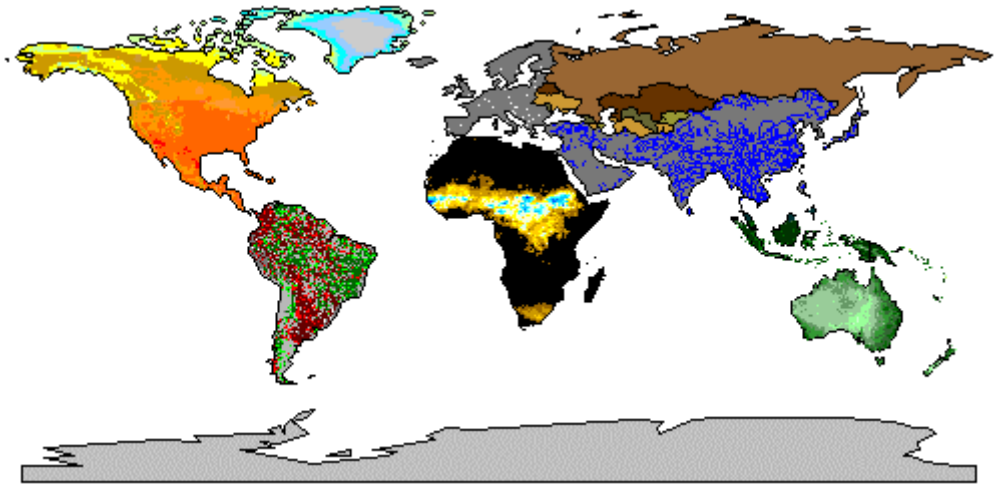

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1. Introduction

This manual was developed to accompany the multilingual version of the PC-based map and image display and analysis software WinDisp Version 4.0. WinDisp is a public domain, easy to use software package for the display and analysis of satellite images, maps and associated databases, with an emphasis on early warning for food security. WinDisp was originally developed for the FAO Global Information and Early Warning System with funding from the European Commission. The system, following several enhancements, has become the Windows-based successor to the DOS based Image Display and Analysis (IDA) software system which was also developed in support of early warning analysis.

1.1. General description of WinDisp 4.0

WinDisp Version 4.0 is multilingual with all menus, on-line help, and reference documents available in English, French and Spanish. WinDisp 4.0 offers varying degrees of automation and ease of use. The software allows users to compare multiple images; extract and graph trends from a number of satellite images, such as during the growing season for comparison with other years; compute new images from a series of images; build custom products combining images, maps and specialised legends; digitise new maps on screen; and to display tabular data in map format. WinDisp 4.0 supports project files which can be developed for specific countries and regions. These allow users to point and click from various data themes to build composite maps and to do some basic early warning analysis in a series of display windows. WinDisp 4.0 has extensive batch processing capabilities which can be utilised to automate routine and tedious tasks, and permits users to develop custom applications and procedures.

WinDisp was developed by Eric Pfirman, Justin Hogue and Linda See, the first two having also developed IDA. The satellite enhanced data interpolation (SEDI) routines included in WinDisp 4.0 were developed by Peter Hoefsloot. This documentation was prepared by Eric Pfirman and Isabelle Charlier, with translations by Isabelle Charlier, Linda See, John Lewis and Andrés Ravelo.

1.2. History of WinDisp

WinDisp has its origins with the Global Information and Early Warning System (GIEWS) of the Food and Agriculture Organization of the United Nations. The GIEWS monitors the global food supply and demand and provides timely warnings about both food shortages and surpluses for individual countries. The GIEWS required an integrated information system to keep up with the ever-increasing flow of data as well as to enable GIEWS staff to distil large inputs of a variety of data into useable and manageable information. In response to this need the GIEWS, with funding and support from the European Commission, developed an integrated information system now known as the *"GIEWS Workstation"*.

WinDisp was developed as the map and image display module of the GIEWS Workstation, permitting GIEWS analysts to analyse, integrate, and overlay digital map and satellite data in common windows on their desktop PCs. It was designed to make the display and analysis of satellite images, maps and associated databases as simple as possible. The image and map file formats used by WinDisp are identical to its DOS based predecessor IDA (see below) which was already widely in use for image analysis within the early warning community at the time WinDisp development began.

WinDisp is often termed the successor to the Image Display and Analysis (IDA) software. While both were contemporaneous for a period, IDA was developed much earlier in the mid-1980s by the USAID Famine Early Warning System (FEWS) Project as a PC based image analysis tool, and was made freely available to anyone who requested it. IDA was initially developed by Eric Pfirman and Richard Collins, with later versions by Eric Pfirman and Justin Hogue. The software was used extensively within the early warning community for the analysis of low resolution, high frequency satellite imagery in near real-time. IDA allowed for the use of satellite images at field level as it operated on most PC platforms available at the time. In the early 1990s, the USAID FEWS Project, the United States Geological Survey EROS Data

Center, and the ARTEMIS system at the FAO Remote Sensing Centre in Rome helped fund upgrades of the software, including support for other languages and a detailed user manual.

WinDisp has evolved from an MS-Windows based image display tool for viewing IDA images in Version 1.0, to a fully functional, multilingual, image analysis and map display software tool for early warning in its current version. This evolution was gradual with WinDisp first being customised and upgraded to meet the needs of the GIEWS, which resulted in WinDisp 2.0. Version 2.0 offered an easy to use, high-level data browsing tool for decision-making support, and provided the user with multiple-window capabilities, support for displaying a wider variety of file formats, and the ability to map tabular data. A "project" interface was added in Version 2.0 which could be customised to provide the user with a list of the available data for a country or specific area, and permitted the creation of detailed menus for selecting, displaying and integrating various tabular data, digital maps and satellite images.

By the time WinDisp 2.0 was finalised and in use by the GIEWS, the IDA user community was looking for an MS-Windows based version of IDA. Though the FAO GIEWS had funded an initial version of IDA for Windows, that software did not take advantage of the full functionality that could be offered under MS-Windows. Since the same team of programmers, led by Eric Pfirman at the University of Arizona, had developed IDA for DOS, IDA for Windows, and WinDisp, it was proposed that WinDisp be enhanced to incorporate all of the analytical features of the IDA for DOS program.

This proposal was agreed upon by many IDA users, and funding was obtained from the US Agency for International Development's Famine Early Warning System (FEWS) Project, the Southern African Development Community (SADC) Regional Remote Sensing Project (RRSP), the USDA Forest Service (USFS) Intermountain Fire Sciences Laboratory, and the US Geological Survey (USGS) EROS Data Center. The new product, entitled WinDisp 3.0, offered all the features and ease of use of the previous WinDisp 2.0, full IDA functionality, several new display and data exploration features, and a powerful batch language giving Version 3.0 production capabilities. The contribution to the further development of WinDisp by these agencies proved beneficial to all involved. The software was enhanced to meet analytical needs of several agencies and early warning systems saving them from having to develop similar software at much higher cost. In addition, to further improving the analytical capabilities of the system, the adoption of WinDisp 3.0 for map and image analysis by the early warning community has allowed the exchange of information between the users to be transparent.

Following the release of WinDisp 3.0, FAO further enhanced the capabilities of WinDisp which resulting in the current Version 3.5. The European Commission was the primary source of funds for the further development of the GIEWS Workstation and WinDisp 4.0. In addition, the FAO Africa Real Time Environmental Monitoring Information System (ARTEMIS) and a *Coopération Française* funded activity at the GIEWS helped fund additional enhancements to Version 3.5.

Version 3.5 added new communication parameters which enables WinDisp to receive automated commands from other software systems, new mapping and legend feature, and the satellite enhanced data interpolation (SEDI) routines derived from the IDA GIS Tools software developed for the Southern African Development Community (SADC). In addition, WinDisp3.5 was modified to support multilingual versions of the menus and on-line help files as part of the effort to distribute the Workstation to other early warning units in non-English speaking countries. A multi-lingual dictionary was created which allows the user to choose between the languages supported by WinDisp.

Version 3.5 supported English and French, and a Spanish interface was added in Version 4.0. Currently all WinDisp menus, the on-line help, and reference documents are now available in English, French and Spanish. The multi-lingual dictionary can be modified to support other languages.

In addition to the new Spanish interface, WinDisp 4.0 also offers new functions with respect to Version 3.5 including on-screen digitizing, the use of ESRI Shape files as a vector file format, and far greater options for developing, automating and customizing map and image legends.

1.3. About this manual

This manual was developed to provide an introduction to WinDisp 3.5 to new users, while also providing some in-depth background and reference materials for advanced users of the program. This updated manual accompanies Version 4.0 and includes information and instructions on the new features added to Version 4.0. This manual builds upon the previous reference materials distributed with the software by Eric Pfirman, and the *IDA for DOS Version 4.2 User Manual* developed for FAO ARTEMIS by Peter Hoefsloot.

Chapter 2 provides detailed descriptions of the WinDisp interface, how to display maps and images, how to develop project files and batch routines, and how to use the image analysis functions. Chapter 3 provides the same information contained in the on-line help available in WinDisp which was produced by Eric Pfirman. Chapter 4 provides a detailed description of the primary file types used by WinDisp.

The data and examples used in Chapter 2 are for Africa and focus on the use of satellite imagery in early warning for food security. Satellite images are often the only information available in near real-time for the arid and semi-arid regions of Africa, which are often subject to drought and poor crop conditions, and where timely and reliable ground information is often difficult to obtain. Two types of satellite data have proven useful for early warning: normalised difference vegetation index (NDVI) images, and cold cloud duration (CCD) images. These images can be used to compare the current growing season with a historical archive of NDVI images dating back to mid-1981, and CCD images dating back to 1988. The NDVI images have a pixel-size of roughly 7.6 x 7.6 km, often called Global Area Coverage or GAC resolution, and the CCD pixel-size is 5 x 5 km corresponding to the native pixel size of the METEOSAT series satellites.

The maps and tabular data used in the examples are from the GIEWS Workstation database which were collected from various sources. The NDVI imagery was produced at the Laboratory for Terrestrial Physics at the NASA Goddard Space Flight Center and are derived from the AVHRR sensor aboard the NOAA series of meteorological satellites. The CCD imagery used in the examples were produced by the FAO ARTEMIS system and compiled from data received from the METEOSAT series of satellites.

1.4. Additional resources

An additional in-depth resource for WinDisp users is a CD-ROM based course and self-study tutorial entitled *"Monitoring of Crops, Rangelands and Food Security at National Level"* produced for developing countries by the Agriculture, Conservation and Environment Division of the International Institute for Aerospace Survey and Earth Sciences (ITC) in the Netherlands. The ITC tutorial is available in English and French.

Also available is the *"WinDisp3 Self-Study Guide: Displaying and Analysing NDVI-Derived Images for Vegetation Greenness and Fire Potential Assessment - Section 1"* by Roberta A. Bartlette of the USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory located in Missoula, Montana USA as part of the *"NDVI Data And Support Tools"* they are distributing over the Internet at ftp://www.fs.fed.us/pub/ndvi/support/windisp3/ .

1.5. Installing WinDisp Version 4.0

The current version of WinDisp, and future updates can be obtained from the FAO GIEWS at http://www.fao.org/Giews/English/Windisp/Windisp.htm . The latest versions of WinDisp, including the beta versions of upcoming releases when available, are also posted by Eric Pfirman at http://Ag.Arizona.Edu/~epfirman/Windisp4.html .

To install WinDisp 4.0 on your computer:
If you are installing WinDisp 4.0 from CD-ROM, place the CD-ROM in your computer and access the \WinDisp 4.0 directory using Windows Explorer, close all other open applications and run (double click) the file setup.exe. If you have downloaded WinDisp from the Internet, locate the wd4setup.zip file, unzip wd4setup.zip into a temporary directory, and run setup.exe.

The WinDisp 4.0 installation program will ask the user to confirm the creation of the WinDisp 4.0 directory in c:\windisp4. Users can modify the location in which to install the latest version of WinDisp (i.e. in cases where you which to maintain earlier version of the software). If a previous version of WinDisp 4.x exists on your computer, the setup routine will write over the older version of the software unless another directory is specified. The installation process can be aborted at any time by clicking the Exit Setup button. Note, if a previous version of WinDisp (3.x) is installed on your computer you may want to remove the older version by simply deleting the files and directory using Explorer in order to free up disk space on your computer.

The WinDisp 4.0 installation program will also ask the user in which language the software should be installed. The selection of language at this stage does not prevent you from modifying the language of WinDisp 4.0 later.

After selecting the desired language and installation directory, click on the computer icon to start installing the software. After a few minutes the installation routine will indicate it has finished installing WinDisp 4.0.

To modify the language after installation of WinDisp 4.0:
Following the installation of WinDisp 4.0 open the Windisp.ini file on your computer and modify the line Language=... as follows:

```
Language=ENGLISH
Language=FRENCH
Language=SPANISH
```

under the [Windisp] section, according to the language you want.

WinDisp users are encouraged to visit the FAO GIEWS WinDisp website at http://www.fao.org/Giews/English/Windisp/Windisp.htm and the WinDisp website maintained by Eric Pfirman at http://Ag.Arizona.Edu/~epfirman/Windisp4.html for updates and information concerning the latest developments in WinDisp.

2. Working with WinDisp 4.0

WinDisp was developed to display satellite images, maps and associated databases. The available functions in WinDisp 4.0 (following the order in the principal menu) are:

File	To open, close, save and print files or to exit WinDisp 4.0
Edit	To cut, copy, paste, cancel, etc.
View	To enlarge or move images, and to display graphs
Draw	To draw points or lines, to write text, etc. within the graphics
Batch	To store menu operations for repetitive use
Options	To define a panel of options for the display of the windows
Process	To apply functions for analyzing images
Window	To choose the format and display of the windows
Help	To open the help file or the presentation window of WinDisp 4.0

This chapter will show you with illustrated examples, how to use these functions. To enhance your knowledge of the possibilities of WinDisp 4.0, consult the detailed information concerning each function in Chapter 3.

All the menus, buttons, etc. conform as much as possible to the standards of Microsoft Windows Common User Access (CUA). Different interface types are available in WinDisp 4.0, providing different degrees of automation:

Buttons (see Section 2.1.): a panel of buttons allows quick access to the most common functions.

Dialog box (see Section 2.2.): all the parameters are linked to menu options by a standard dialog box.

> Browse buttons: the browse buttons included in the dialog boxes allow quick access to many standard parameters such as files, colors, types of point, line and fill, and fonts.

Projects (see Section 2.5.): a series of presentation commands can be combined in a project, to allow easy access to many data layers for the same region.

> Variables: variables can be defined allowing the user to select parameters from a range of parameters. This is typically adapted to the selection of images, map layers and data fields within a project.

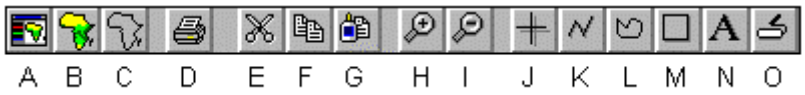
Batch (see Section 2.6.): a batch file contains the executed functions and allows automatic retrieval of specific routines. The panel of functions includes the ability to use if-then statements, for-next loops, go-to labels and substitution of variables.

Important

You will find all the files used to illustrate this chapter in the accompanying users' support manual. This will allow you to reproduce examples identical to these, in order to clearly understand how WinDisp 4.0 opertates. Be careful, however, to copy the necessary files in the correct place on your hard disc, or to adapt the instructions to allow adequate access to the particular directory path.

2.1. Buttons

The most current functions are directly accessible by using the buttons above the main window. Of the following functions only the first three are available by default; the others appear when a window in opened:

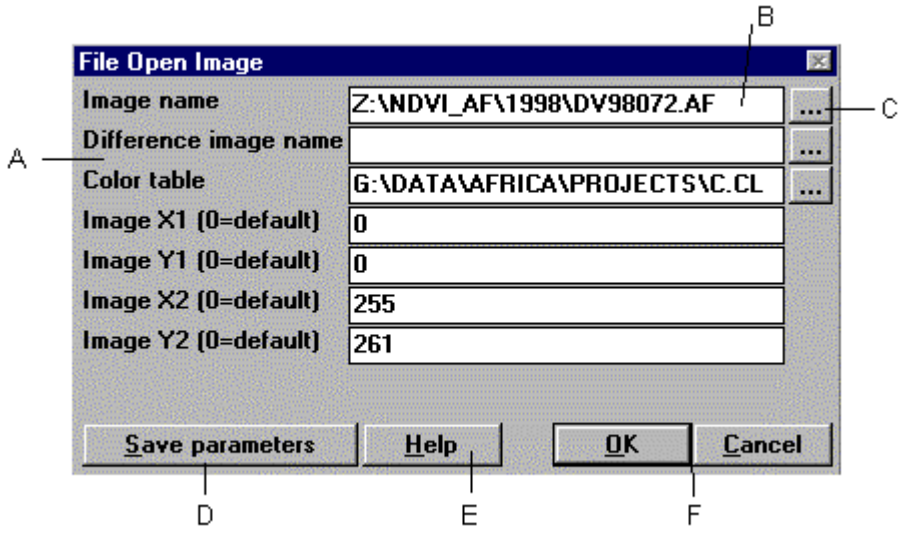


A. **Open project** To open a project in a new window.
B. **Open image** To display an image in a new window.
C. **View map** To display a map in the active window, or to superimpose a map onto an image, a bitmap or a map already displayed in the active window.
D. **Print** To print the contents of the active window.
E. **Cut** To cut a portion of graphics or text and to copy it to the clipboard.
F. **Copy** To copy a portion of graphics or text to the clipboard.
G. **Paste** To paste the contents of the clipboard to the active window.
H. **Zoom In** To zoom in on the image in the active window.
I. **Zoom Out** To zoom out on the image in the active window.
J. **Draw point** To draw one or several points in the active graphics window.
K. **Draw line** To draw a line in the active graphics window.
L. **Draw region** To draw a polygon in the active graphics window.
M. **Draw box** To draw a rectangle in the active graphics window.
N. **Add text** To write text in the active graphics window.
O. **Color polygon** To color a polygon in the active window.

To obtain more details concerning these functions, refer to Chapter 3.

2.2. Dialog boxes

A dialog box will appear for each function of the menu requiring specification of parameters. This furnishes the user with a reliable interface that is easy to use.



A. **Description of parameters**
The left side of the dialog box contains short descriptions of the parameters to be entered.

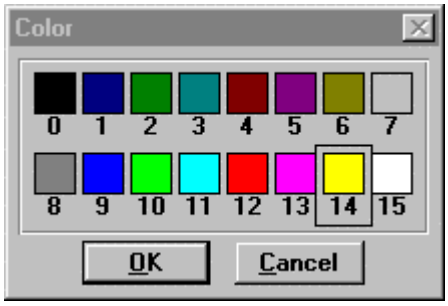
B. **Parameters**

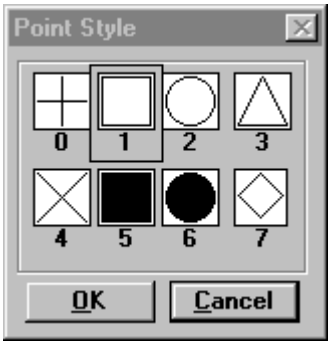
The blanks on the right side of the dialog box are the spaces in which the user must enter the values of the required parameters. Once the parameters have been entered, they will appear each time the dialog box is opened. If they have been saved in the initialization file, they will appear the first time the dialog box is opened. If a browse button is available, clicking it will give you access to a browse box in which you can directly select a parameter. Variables can be included in the parameters by delimiting the variables with % signs. The text designating a valid parameter appears in black. A color other than black indicates an invalid parameter. In some cases, (for example, a difference image), the parameter is optional and the box can therefore be left blank.

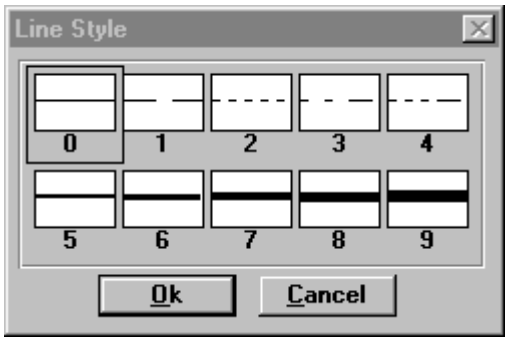
C. **Browse buttons**

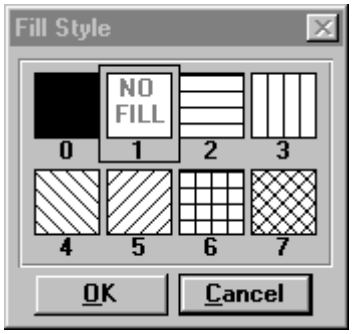
To choose a parameter from a browse box, click on the browse button. Browse boxes are available for a variety of parameters, including files, colors, types of points, lines and fill, fonts and data fields.

Browse buttons give you access to the following windows from which you can choose colors, styles of points, lines and background:









D. **Save parameters button**

If you want the defined parameters for later use in WinDisp 4.0, click the save button. This operation will save the parameters in the initialization file of WinDisp 4.0, and each time the file is opened they will automatically be loaded.

E. **Help button**

Click the help button for a description of this function and its parameters.

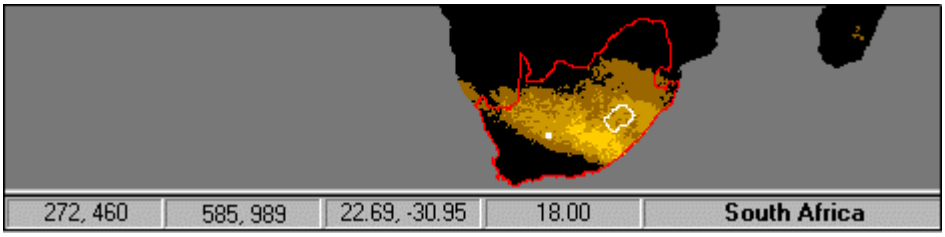
F. **OK/Cancel**

When all the parameters have been entered, click OK to execute the function, or Cancel to abort the execution.

2.3. Status bar

The status bar situated under the principal window shows information about the image or the map in the window.

As seen in the illustration below, five boxes of the status bar are reserved for the following information:
- the co-ordinates of the screen for the place where the cursor is located (seen in this image as a white point): 272,460
- the co-ordinates of the image for the place where the cursor is located: 585, 989
- the values of the longitude and latitude for the place where the cursor is located: 22.69, -30.95
- the value of the pixel for the place where the cursor is located: 18.00
- the name of the cartographic feature selected (a selected area appears in red on the screen): South Africa.



2.4. Displaying information

In order to illustrate the first three sections of this chapter, a simple and concrete example will be given. It entails preparing and presenting a bitmap of Mali from a satellite image covering all of Africa. All the manipulations of the image in this example can be saved in the form of a batch file (see Section 2.6.), which allows you to retrieve it automatically.

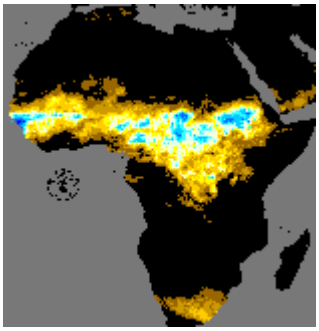
2.4.1. Selecting and using display windows

To open an image, a map, bitmap or text, you have a choice of File commands: File Open or File Retrieve. Use File Open to display a selected file in a new window. Use File Retrieve to display a file in the active window. A table, a film, or a project must be opened in a new window with File Open. To bring back a window that was previously active in order to superimpose information in the active window, you can retrieve it simply by clicking on its icon that appears in the menu in the lower part of the screen.

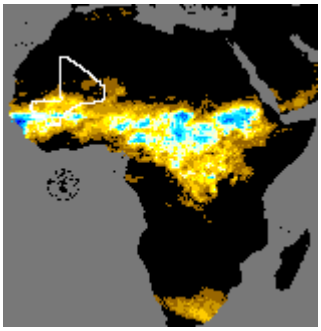
An image must be shown before a map can be retrieved. It is necessary to avoid opening several images in the same window.

To view an entire image, use 0 as the default value for each of the co-ordinates.

Preparation of the image of Mali
The image covering all of Africa is opened using the command File Open Image:



The map of Mali is superimposed using the command File Retrieve Map:



2.4.2. Changing the display for images and bitmaps

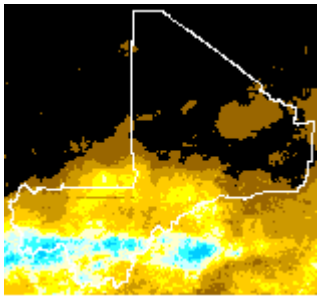
When an image or bitmap has been opened, you can change the display using the commands View Zoom or View Pan. These commands can be used only within a normal window in a project. They cannot be deleted using the command Edit Delete. This command executed after a zoom or after moving an image will annul the command executed before the Zoom or Pan command, which will result in the loss of information.

The commands under the View Zoom menu will allow you to change the size of an image or bitmap. The commands under the View Pan menu will allow you to view a neighboring part of an image or bitmap.

In more detail, the commands available under the View Zoom menu are the following:
- Zoom In: to zoom in on the current graphic window.
- Zoom Out: to zoom out on the current graphic window.
- Previous: to view the preceding image.
- Total: to view the entire image or bitmap.
- Feature: to zoom in on a selected feature.
- Lat/Long: to zoom in on an area determined by latitude and longitude co-ordinates.

The View Previous command allows you to retrace all the layers in the active window. This function is most often used when the window size is changed. The zoom factor of all the maps and images is recalculated to adapt to the new window.

Preparing the image of Mali
View Zoom is used to reduce the view to the area that interests us: Mali.



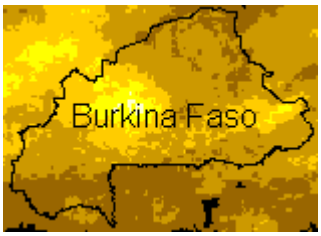
Use the View Zoom In command, selecting the area with the cursor, the View Zoom Lat/Long if the latitude and longitude values are known, or the View Zoom Feature by clicking on the map of Mali.

2.4.3. Changing the presentation

Under the Edit menu you will find the usual operations (Undo, Cut, Copy, Paste, Delete). Details for using each of these commands is found in Chapter 3.

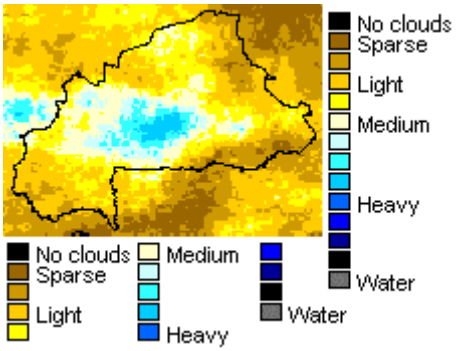
Under the Draw menu, you will find options allowing you to improve the presentation of a window. This is particularly useful in the case of a image that you wish to print or to save as a bitmap. The commands in the first part of the Draw menu allow you to create a point, a line, a polygon or rectangle in the dimensions that you specify, to write text, or to color an object or a feature.

The Draw Labels command allows you to write the names of the cartographic features on an image in the font and color you choose. The text will appear in the center of the object.



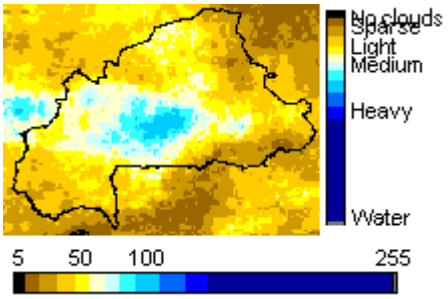
The command Draw Legend allows you to draw the legend in the font and color you choose. The location and size of the legend can be determined using the cursor. See the example at the right.

This diagram also shows an example of a special legend format. A classic legend is available by default by using the Options Show Legend command and setting the map and image legend to 0.



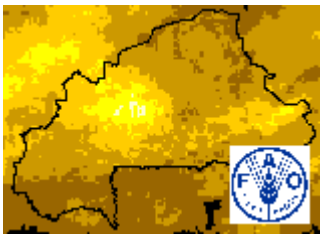
The Draw Color Bar command allows you to draw a color bar and choose the font and color of the text. You can see which colors are associated with the values of an image. It reproduces graphically the size of the classes of image values and the corresponding colors.

The location and the size of the color bar can be determined using the cursor. See the two examples at the right. The text viewed is situated in the legend field of the color bar (see section 2.4.5.). To improve the presentation, it may be necessary to adapt the contents of this field to your needs; for example, substituting the description attached to the pixel values, as shown in the example to the right.



The Draw Bitmap command allows you to superimpose a bitmap on the image on-screen by choosing the location with the cursor.

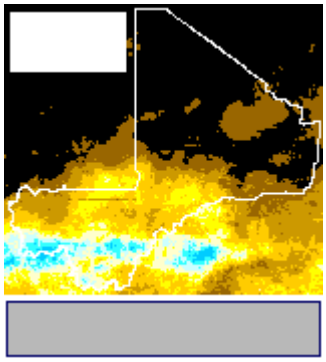
The difference between this command and File Retrieve Bitmap is that you can position the bitmap with Draw Bitmap.



Preparation of the image of Mali

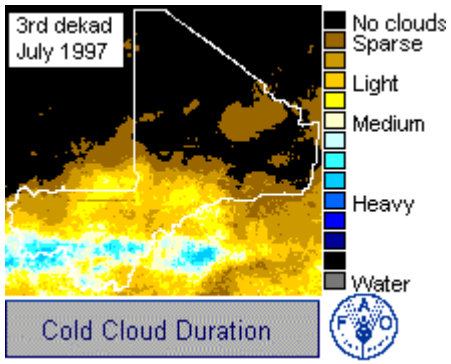
With the command Draw Box you can create an area where you can write text (title, explanation, etc.). You can choose the color of the rectangle, the style and color of the border and the background.

Use the command Edit Cut to create a blank area in the image.



Character strings are introduced using the command Draw Text, which allows you to choose the font and the color of the text. The location of the text can be determined using the cursor

The legend as shown in the example above is drawn with the command Draw Legend, and the logo is added with the command Draw Bitmap. When you are satisfied with the presentation, you can save it in the form of a bitmap with the command File Save Bitmap.



2.4.4. Displaying cartographic data

One of the functions of WinDisp 4.0 is to display a table of numerical data in the form of a map, provided that the cartographic information strictly conforms to the order in the map file (*.bna) and in the accompanying table. The first line of the data file is a list of the fields contained in that file. The following lines contain a cartographic feature label followed by the values of data for each of the fields given in the first line.

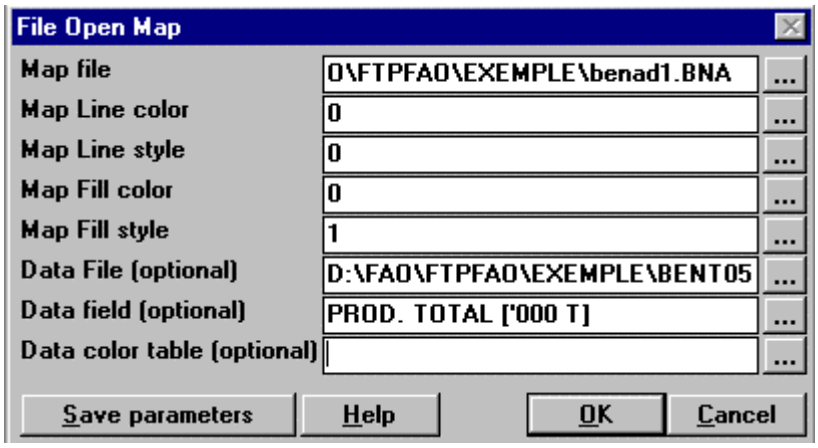
For example, the data in a table containing statistics for the provinces of a country can be displayed in the form of a map. The following is a file of statistics containing five fields of data relating to the production of oil-producing plants in Benin. Notice the line of '-9999', meaning "no data" for the province of Borgou:

```
Region,Total Prod. ['000 T],Prod. per capita [kg/per],Yield [kg/ha],Cult.Area/Total Area [pct],Harvested Area [ha]
Atakora,7.16,11.5,839,0.27,8534
```

```
Borgou,-9999,-9999,-9999,-9999,-9999
Zou,22.79,31.18,785,1.55,29032
Mono,9.26,15.17,789,3.09,11736
Atlantique,5.03,5.54,703,2.22,7155
Oueme,9.59,11.9,728,2.8,13173
```

The separator used must be a comma; therefore the decimal numbers must contain a point and not a comma.

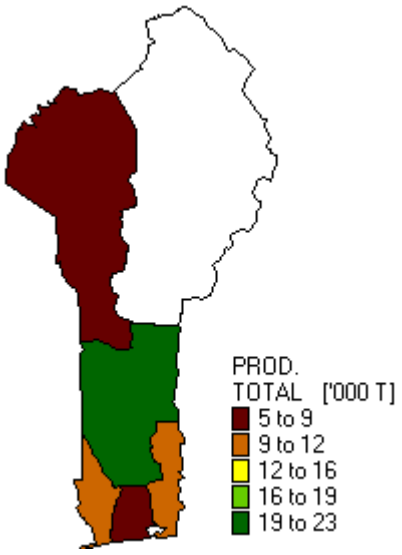
The display is made by using the parameters 'Data File (optional)', 'Field of data (optional)' and 'Color table data (optional)' in the File Open Map window.



The map parameters displayed in the dialog window is shown on the map to the right:

Since the total production of oil-producing plants for the province of Borgou is not known (-9999), this province has no color in the display.

If a certain area of a map has not been colored in, the cause should be verified. It may be due to a difference in font between the object in the map file and that in the data file.



The tables, just as their fields, can be linked to variables in the project files (*.prj), as you can see in the following project extracted from the example given in Section 2.5.7.:

```
[Parameters]
Title,Cultivation," "
Data AGDAT,File Retrieve Map,"c:\data\maps\ben\benad1.bna,0,,,1,c:\data\agdat\ben\ben%Cultivated%.dat,%Info%,"

[Variables]
[Cultivated]
Total oil-producing plants,t05
Fonio,011

[Info]
Production total ['000 T],Total Prod. ['000 T]
Production per capita [kg/per],Prod. per capita [kg/per]
```

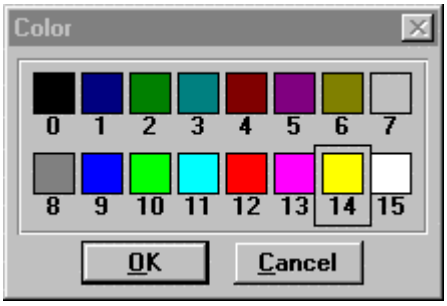
Yield [kg/ha],Yield [kg/ha]
Cult.Area/Total Area [pct],Cult.Area/Total Area [pct]
Harvested area [ha],Harvested Area [ha]

2.4.5. Creating a legend using color tables

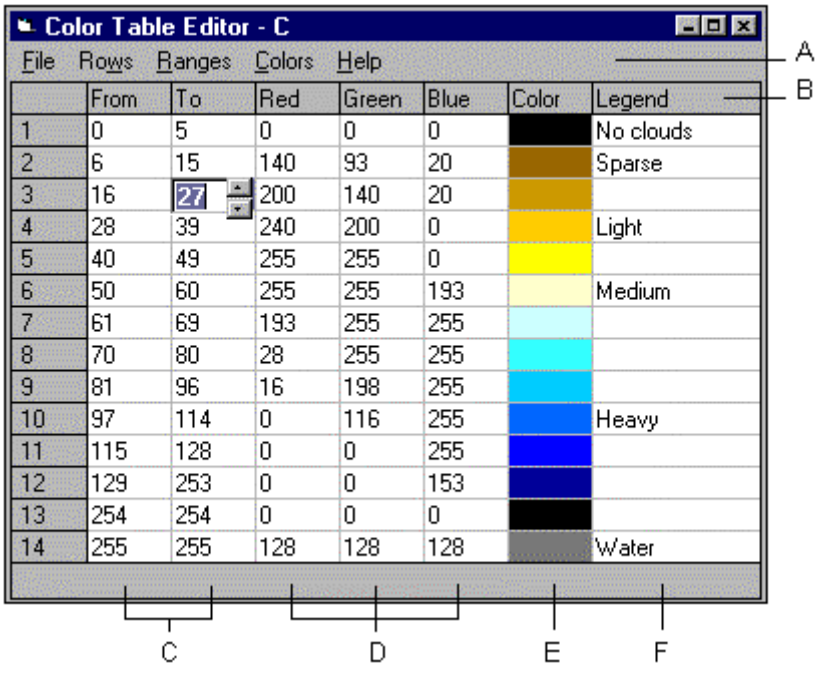
Color tables are used to transpose the values of the image pixels (DNs - Digital Numbers) to specific colors when displaying an image. Each color is designated to a different class of data on the map. Text describing each color can be included and shown in a legend.

Because of difficulties in working with the Windows palette, a limited color scheme has been implemented. Each color in the color table is mapped to the most similar color in the Windows palette. These colors are shown in the list below (standard EGA colors). To insure accurate color representation, it is best to choose colors from this list.

VALUE	COLOR	RED	GREEN	BLUE
0	Black	0	0	0
1	Blue	0	0	128
2	Green	0	128	0
3	Cyan	0	128	128
4	Red	128	0	0
5	Magenta	128	0	128
6	Yellow	128	128	0
7	Light gray	192	192	192
8	Dark gray	128	128	128
9	Light blue	0	0	255
10	Light green	0	255	0
11	light cyan	0	255	255
12	Light red	255	0	0
13	Light magenta	255	0	255
14	Light yellow	255	255	0
15	White	255	255	255



The color table editor can be used to create and edit color tables. Use the command Option Edit Color Table. The name of the edited table will be written on the bar at the top of the window.



	From	To	Red	Green	Blue	Color	Legend
1	0	5	0	0	0		No clouds
2	6	15	140	93	20		Sparse
3	16	27	200	140	20		
4	28	39	240	200	0		Light
5	40	49	255	255	0		
6	50	60	255	255	193		Medium
7	61	69	193	255	255		
8	70	80	28	255	255		
9	81	96	16	198	255		
10	97	114	0	116	255		Heavy
11	115	128	0	0	255		
12	129	253	0	0	153		
13	254	254	0	0	0		
14	255	255	128	128	128		Water

A. **Edit Color Table Menu**

File

New	Create a new color table (specify the number of lines)
Open	Open an existing color table (specify the name of the file)
Save	Save the color table under the same name
Save As	Save the color table under a new name
Exit	Exit the editor and return to the main window

Rows

Insert	Insert one or more lines under the line selected
Append	Add lines to the end of the table
Remove	Remove one or more selected lines
Define	Define the exact number of lines to create
Clear	Delete the values of the selected lines

Ranges

Images

Equal Intervals	Create classes with equal intervals, based on the max/min values of the image
Equal Quantiles	Create classes each containing the same number of values
Unique Values	Create a line for each unique image value

Maps

Equal Intervals	Create classes with equal intervals, based on max/min values
Unique Values	Create classes for each unique value
Percentiles	Create classes in percentiles intervals based on max/min values
Quartiles	Create quartile classes (4) based on max/min values
Logarithmic	Create logarithmic based classes using max/min values

User defined

Equal Intervals	Create classes with equal intervals based on predefined max/min values
Unique Values	Create a line for each unique value

Clear	Delete all the values of classes and replace them with 0

Colors

Black to White	Create a gradual shading of colors going from black to white, on all or on a selection of lines
White to Black	Create a gradual shading of colors going from white to black, on all or on a selection of lines
Red to Green	Create a gradation of colors going from red to green, on all or on a selection of lines
Red to Blue	Create a gradation of colors going from red to blue, on all or on a selection of lines
Red and Blue	Create a gradation of colors going from gradations of red to gradations of blue, on all or on a selection of lines
Bright Red and Blue	Create a gradation of colors going from gradations of bright red through gradations of blue, on all or on a selection of lines
Blue to Green to Red	Create a gradation of colors going from blue through green to red on all or on a selection of lines
Mixed Palette	Create a series of mixed colors based on the 16 EGA color scheme on all or on a selection of lines
Clear	Delete all the colors and replace them with 0, 0, 0 (black), on all or on a selection of lines
Help	Open the help file dealing with editing color tables

B. **Description of fields**

A color table contains six fields delimited by spaces. The first line of the editor describes the fields.

Sample Color Table

FROM	TO	RED	GREEN	BLUE	LEGEND
0	2	255	255	255	Clouds
3	82	0	0	128	Water
83	94	128	128	0	Dark soil

95	110	255	255	0	Light soil
111	115	0	255	0	Light vegetation
116	130	0	128	0	Medium vegetation
131	255	128	0	128	Dense vegetation

C. **FROM and TO fields**
The fields FROM and TO delimit the range of image values assigned to a color. For an image, these values must be in the range of 0 to 255, and correspond to the actual digital counts, not the derived values such as for NDVI. Each value should be associated with only one color. They should not overlap. The value of a color should be greater than the TO value in the previous color. The color table editor allows you to change the values directly in the color table, and the new table can be saved using the File Save or the File Save As command.

D. **RED, GREEN, and BLUE fields**
The RED, GREEN and BLUE fields allow you to define the intensity of each primary color (from 0 to 255), in order to set the color that will be associated with each class of image values.

With the color table editor, the values can be changed directly in the table, allowing you to see the result of the combination of the three colors in the 'Colors' column. The new table can then be saved using the File Save or File Save As commands.

E. **Colors**
The color corresponding to the combination of intensities of the three primary colors is presented in this column. Clicking on the color will open a window containing the 16 standard EGA colors. Clicking on one of the standard colors will automatically replace the old color of the table, and the intensity values will be adapted. The new table can be saved with File Save or File Save As.

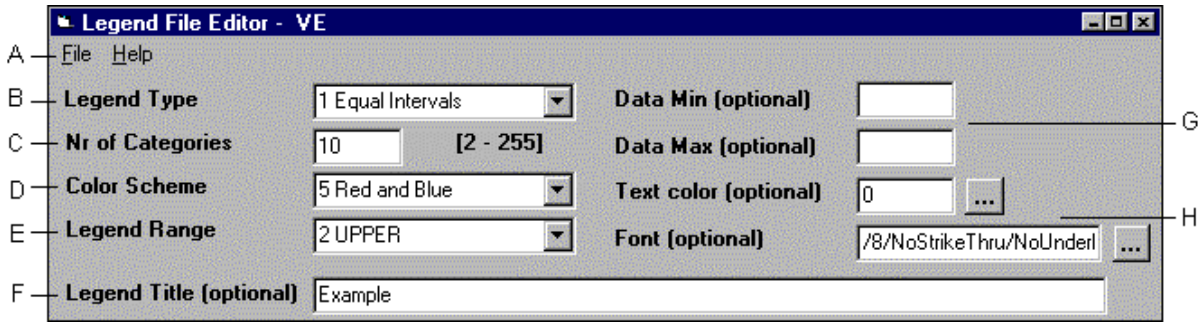
F. **LEGEND field**
The LEGEND field is an optional text field which can be displayed next to the colors in the legend.

2.4.6. Creating a legend using legend files

Legend files are used to control and customize the parameters used for the automatic generation of map legends. These are ASCII files, and can be created using the legend file editor described below.

Legend definition files are language independent and can, once created can be used with WinDisp 4.0 operating in any language. The file format consists of a both numeric and alpha-numeric values, though only the numeric values are used by the software, while the alpha-numeric strings are used to describe the parameters selected. The alpha-numeric strings are displayed by the legend file editor allowing users to view the description of the parameters selected.

The legend file editor can be used to create and edit legend files using the menu Options Edit Legend File. The name of the legend file being edited will appear in the header bar of the active window as shown:



A. **The Edit Legend File Menu**

File

New	Create a new legend file
Open	Open an existing legend file (specifying path and file name)
Save	Save the legend file with the existing name
Save As	Save the legend file with a new name
Exit	Exit the Edit File legend menu and return to the main menu
Help	Open the help file dealing with legend files

B. **Types of legends**

The following type of legends can be created:

1 Equal Intervals
2 Unique Values
3 Percentiles
4 Quartiles
5 Logarithmic

If no option is selected and the line is left blank, WinDisp 4.0 will use as default: 1 Equal Intervals

C. **Number of classes**

The number of classes possible depends on the type of legend selected. The number of classes available are displayed once the user has selected the legend type. The number of classes that can be selected for each legend type are as follows:

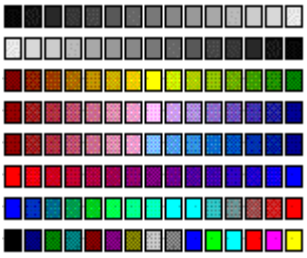
Equal Intervals : 2 to 255
Unique Values : depending on quantity of values
Percentiles : 2 to 100
Quartiles : 4
Logarithmic : 2 to 255

If no option is selected and the line is left blank, WinDisp 4.0 will use as default: 10 (except for Quartiles for which the number of classes is always 4)

D. **Color Scheme**

The color schemes available are identical to those available in the color table editor:

1 Black to White
2 White to Black
3 Red to Green
4 Red to Blue
5 Red and Blue
6 Bright Red and Blue
7 Blue to Green to Red
8 Mixed Palette

 or other random combinations

If no option is selected and the line is left blank, WinDisp 4.0 will use as default: 3 Red to Green

E. **Legend Range**

This parameter allows users to specify Full if they wish to see both the upper and lower data value limits for each legend class (eg. 50 to 100), or to specify Upper if they only want the upper data value appear for each class in the legend (eg. < 50).

If no option is selected and the line is left blank, WinDisp 4.0 will use as default: 1 Full

F. **Legend Title (optional)**

This parameter allows users to specify a legend title and is optional. The title uses the text and font color specified by the user.

G. **Data Min/Max (optional)**

These parameters allow users to specify the lower and upper data values to be mapped and are optional.

If no option is selected and the line is left blank, WinDisp 4.0 will use as default the actual dataset minimum and maximum.

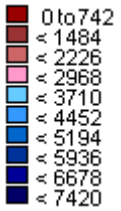
H. **Text Color and Font (optional)**

These parameters allow users to specify the text color and font to be used in the legend and are optional.

A legend file created using the parameters used in the example above would be saved in a file as follows:

```
Type=1 Equal Intervals
NrOfCategories=10
ColorScheme=5 Red and Blue
LegRange=2 UPPER
LegTitle=Example
DataMin=
DataMax=
Font=/8/NoStrikeThru/NoUnderline/NoItalic/NoBold/
TextColor=0
```

When used, the legend which will appear will look as follows:



Compared to color tables, legend files provide greater flexibility for creating legends, as they allow users to define the legend parameters (which are then applied based on the values in each map data file) to for an entire dataset, rather than having to create an individual color table for each map data file (i.e. the parameters used for mapping population data when saved in a legend file can be applied to multiple map data files). Legend files can be used effectively in project files to ensure the appropriate mapping and legend definitions are automatically applied each map data type. An example of the use of a legend file in a project file is a follows:

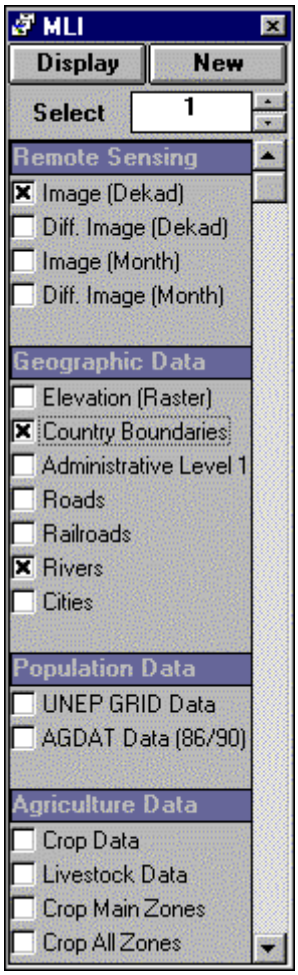
```
Crop Data,File Retrieve Map,"c:\data\maps\benad1.bna,0,,,1,c:\data\agdat\ben%Crop%.dat,%Info%,c:\data\crop.lgd"
```

which will apply the parameters found in the legend file c:\data\crop.lgd rather than using a color table.

Legend files can also be used directly from the menu commands File Open Map, File Retrieve Map and Draw Legend in place of color tables.

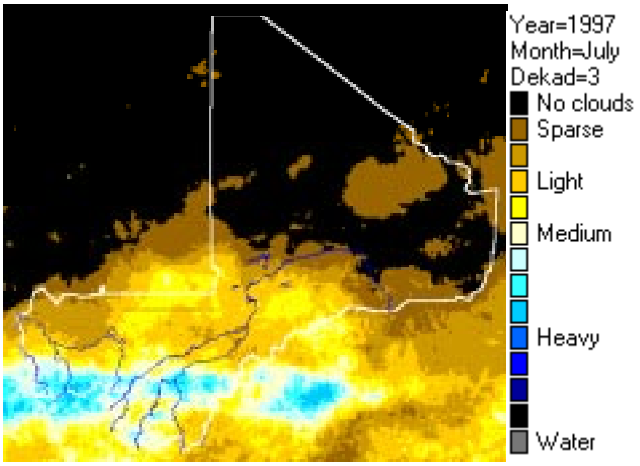
2.5. Projects

A project is a collectiion of satellite images, maps, etc. and the parameters used to display them. It allows you to assemble under the same menu various information about a given subject.



The parameters used to display this information are organized into an ASCII text file and accessed through a dialog box located on the left side of the main window. You can see in the example at the left the various kinds of information that can be included in a project: images, maps and statistics. From the project dialog box, you can check off the layers that you wish to see, and display them in the active window or in a new window.

In this example, the user chose to display a dekad (ten day) satellite image using predefined variables (described in a later section), and superimpose national boundaries and the rivers of the country. The result obtained by clicking on the Display button is shown below.



2.5.1. Creating a project

To create a new project, use the command File New Project from the menu. You will be able to select layers using the commands File Retrieve ... and put them in a file. To add a layer from the Draw menu, you will have to furnish the coordinates using the dialog box.

You will be asked to give a key-word, or descriptor, to identify each layer you add to the project file. A check box will appear in the project window with the new descriptor and a box to select the next layer. If the active window is the display window, the new layer will be drawn. Otherwise you can select the layer and click the Draw command to see the new layer. Values and descriptors can be deleted from the list by selecting them and pressing the Delete key. You must then confirm if you want to delete that item from the list.

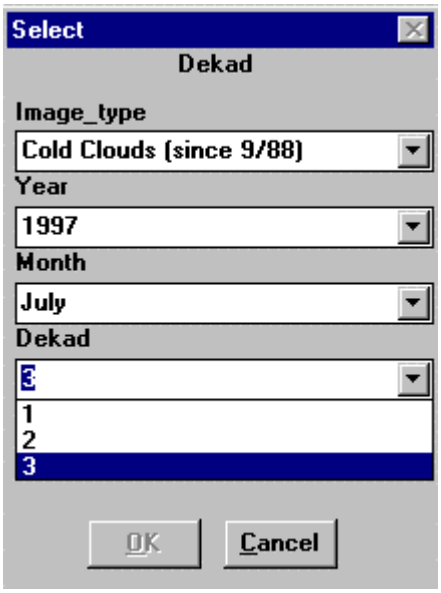
After all the desired layers have been added, save the project using File Save Project. The contents of the project will be saved in the form of an ASCII text file.

2.5.2. Using variables

When adding or editing a project layer, you may want to allow the selection of a parameter, or part of parameter, from a list of possible choices. To do this you can include a variable in the parameter.

The name of the variable must be delimited by % signs before and after. For example, the user can specify the precise date of the image desired with the command:

c:\images\%Type_image%\d%Type_image%%year%%month%%dekad%.af



When you select a layer that contains variables, a dialog box appears. This window contains a scroll list permitting you to select the descriptor for each variable.

The window at the left shows a layer of the project 'Satellite Image Dekad' illustrated on the previous page. The values chosen for the variable are displayed in the spaces just below the descriptor of the layer.

In the project file (in ASCII text format) the command line written above, contains all the variables to start a project. In the section [Variables] is the list of values for each variable and its corresponding descriptor.

In the example reproduced in section 2.5.7, on the next page, 'Cultivation' is a variable, 'Fonio' is a descriptor, and '011' is a value. If a variable is written several times in a chain of parameters, it will appear only once in the selection window.

2.5.3. Displaying a project

After a project has been created and saved, it can be opened with the File Open Project command. Select the layers to be displayed by clicking on the descriptor for each layer. A check mark ☒ will appear to the left of the descriptors chosen. If a parameter of a layer contains a variable, a dialog box appears in which you enter the values for the variable.

When all the desired layers have been selected, click on the Display button. If several windows are open at the time, you can select the display window in several ways: you can click on the desired window before selecting the layers, and then display the layers in this active window or you can click on the desired window through the selection bar at the top of the project window. A new window can be created with the New button.

2.5.4. Editing a project

Projects can be edited in two ways. A knowledgeable user can open a project as an ASCII text file with the Windows Notepad or with File Open Text within WinDisp 4.0, and make changes in the ASCII text file.

An open project can be edited directly. To change the parameters in a layer, double-click on the layer graphic in the project box. The dialog box of that layer will appear, and you can make the necessary changes there. To delete a layer, simply click on that layer and press the Delete key. To add a layer, open the project window and perform the desired functions from the menu or the button bar. Do not forget to save the project if you make changes.

2.5.5. Saving a project

When a project has been created, it can be saved with the File Save Project menu option. You will be asked to supply a name for the file, preferably with a (.prj) extension.

The layer descriptors, functions and parameters will be saved in the Parameters section of the ASCII text file. The variables, descriptors and values will be stored in the Variables section, and the types of information and the variables chosen for each layer in each window will be stored in the Settings section.

2.5.6. Sample project

The execution of a project is based on the storage of menu commands necessary to open a database and run the program when a user chooses to display the information. In the project there is a line, or a group of lines if there are variables, with the available information structured exactly in the same way as if the commands were executed manually.

```
Information,Option,"Parameters"
```

"Parameters" are separated by commas, in the order in which they appear in the corresponding dialog box.

In order to write a title on the display, use the following line of commands:

```
Title,Title desired for the section,"(no  parameters)"
```

Note in the following example, the variables are delimited by % signs; this gives the user access to the file where the desired information can be found. The variables are replaced automatically by the values selected. When a variable (example %Type%) appears several times in a file it is replaced successively by the different indicated values in the project following the selected descriptor.

To illustrate this, the example presented at the beginning of this chapter will be used to view the dekad satellite image for the duration of cold cloud summits (CCD - Cold Cloud Duration) during the third dekad of July 1997. The part of the project used to find the file you want is the following:

```
Title,Satellite Image," "
Dekad,FileRetrieveImage,"c:\%Type%\%Year%\D%Type%%Year%%Month%%Dekad%.af,,c:\data\projects\%Type%f.clr,
88,174,341,401"
```

The project will replace the first %Type% by **ccd_af**, the second by **c** and the last by **c**, since in the project you will find the variable [Type], there are three values separated by *:

```
[Variables]
[Type]
Cold Cloud Duration,ccd_af*c*c
```

Proceeding the same way for the other variables (%Year%, ...), you can access the selected file, which for this example is:

```
Title,Satellite Image," "
Dekad,File Retrieve Image,"c:\ccd_af\1997\Dc97073.af,,c:\data\projects\c.clr, 88,174,341,401"
```

The first directory path is the data file; the second one is the color file.

2.5.7. Sample project file

A project file as described above follows:

```
[Parameters]
Title, Satellite Image," "
Monthly,File Retrieve Image,"c:\%Type%\%Year%\m%Type%%Year%%Month%.af,,c:\data\projects\%Type%.clr,0,0,0,0"
Title,Geography," "
National borders,File Retrieve Map,"c:\data\maps\ben\bennat.bna,0,,,1,,,,"
Provinces,File Retrieve Map,"c:\data\maps\ben\benad1.bna,0,,,1,,,,"
Roads,File Retrieve Map,"c:\data\maps\ben\benrds.bna,4,,,1,,,,"
Cities,File Retrieve Map,"c:\data\maps\ben\bencity.bna,8,,,0,,,,"
Title,Agriculture," "
Data AGDAT,File Retrieve Map,"c:\data\maps\ben\benad1.bna,0,,,1,c:\data\agdat\ben\ben%Agriculture%.dat,%Information%,"
Cultivated areas,File Retrieve Map,"c:\data\maps\ben\ben%Agriculture_Zone%1.bna,12,,,7,,,,"
Principal crop,File Retrieve Map,"c:\data\maps\ben\ben%Crop%p1.bna,0,,,7,c:\data\projects\calendar.dat,Month,O"

[Variables]
[Agriculture]
Millet,011
Corn,012
```

```
[Information]
Total production ['000 T],Total Prod. ['000 T]
Production per capita [kg],Prod. per capita [kg/per]
Yield [kg/ha],Yield [kg/ha]
Cult.Area/Total Area [pct], Cult.Area /Total Area [pct]
Harvested area [ha],Harvested Area [ha]

[Agricultural_Zone]
Princ. zones for manioc,cass
Princ. zones for corn,maiz

[Crop]
Princ. Crop-corn,maiz
Princ. Crop- sorghum,sor

[Type]
Vegetation index,ndvi*v*v
Cold clouds,ccd*c*c

[Year]
Average*Av
1996,1996*96
1995,1995*95

[Month]
January,01
February,02

[Settings]
[Window1]
Monthly,O,Month=Janvier=01
National borders,N
Provinces,O
Roads,N
Cities,O
Data AGDAT,O, Crop=Corn=012,Field=Harvest [kg/ha]=Harvest [kg/ha]
Agricultural areas,N
Principal crop,O,Main_Planting= Princ. Crop sorghum=sor
Title,N
```

The [Parameters] section is the 'body' of the project, and is always required. The [Variables] section is required when a minimum of one variable is present in the [Parameters] section, and the [Settings] section is optional.

2.6. Batch

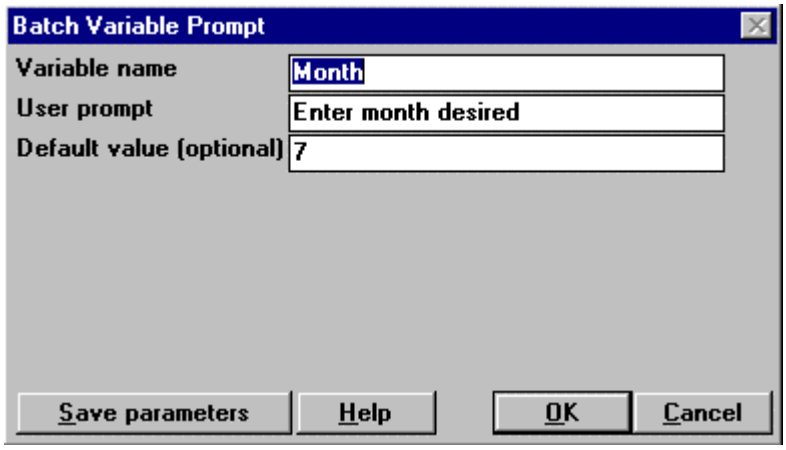
Batch processing is an effective way to automate repetitive tasks. All of the main display and processing functions can be saved in a batch file to be used later. The batch file is written in ASCII text format, and can be easily edited. Variables, if-then statements, for-next loops, and goto-label jumps can be used in a batch file.

2.6.1. Creating and using batch files

To create a batch file, select Batch Record from the menu. You will be asked to give a filename to the batch file. After this, each WinDisp 4.0 command that you execute will be saved to the batch file. When you are finished recording, select Batch Stop in the menu.

These commands can now be executed again by selecting Batch Play and specifying the name of the file.

To see what the batch file looks like, and to make changes to it, use Batch Edit.



If you want to execute the commands one at a time, use Batch Debug; with this option you can also change parameters in each step before executing them.

See the example at the left.

2.6.2. Batch file format

The basic format for a command in a batch file is:

Function, "Parameters"

where Function is the menu command and "Parameters" are the parameters associated with this command. The "Parameters" are listed, separated by commas, in the same order as in the dialog box corresponding to the menu command.

For example, a command to display an image might look like this:

File Open Image, " c:\ccd_af\1997\Dc97073.af,,c:\data\projects\c.clr, 88,174,341,401"

It is important to note:
- The option Function is effected by the case of the letters used.
- Blank lines can be used to separate groups of commands and do not have an effect on the execution.
- Spaces and tabs at the beginning of a line are ignored and can be used to separate groups of commands.
- Long commands can be written on several lines. The beginning and end of a command is designated by quotation marks.
- Comments can be added in a batch files by denoting it as a comment line by starting the comment string with a # sign.
- Variables are delimited on each side by % symbols. If the users wishes to use the % symbol for other than denoting a batch variable, a pair of %% symbols must be used.

2.6.3. Using variables

Repetitive tasks can be simplified by using variables in a batch file. For example, dekad images (every 10 days) can be given file names similar to the one shown on the previous page (dc97073.af), substituting variables for the month and dekad. The month and dekad will be stored as variables and used to specify the correct file name.
The user will then be prompted to enter the number of the month and dekad for the image desired. The responses will be read into the batch file to identify the image to display.

The dialog would look like this:

```
Batch Variable Prompt, "Month, Enter month desired, 7"
Batch Variable Prompt, "Dekad, Enter dekad desired, 3"
File Open Image, "c:\ccd_af\1997\Dc97%Month%%Dekad%.af,,c:\data\projects\c.clr, 0,0,0,0"
```

After replacing the variables by the values attributed to them (see section 2.6.4.), (%Month% by 07 and %Dekad% by 3), the command line becomes:

```
File Open Image, "c:\ccd_af\1997\Dc97073.af,,c:\data\projects\c.clr, 0,0,0,0"
```

The open file can now be used to display the desired image. Note that value entered by the user is 7 rather that 07 in the %Month% field, and was modified using the if-then statement example provided in section 2.6.4 below.

It is important to note:
- If you include variables in a parameter during Batch Record, the command is saved to the batch file.
- Variables can be assigned values within the batch file using Batch Variables Set and with Batch For Begin.
- If you include a variable in a batch but do not set its value, you will automatically be asked for a value during execution.
- With Batch Variable Set you can use algebraic expressions and include other variables in the expression.

2.6.4. If-then statements

With the command Batch If, an if-then statement can be used in a batch file as an error check, and allows the user to validate values for the variables. In programming procedures the commands of an if-then statement are indented to improve the readability.

```
Batch If Begin, "(%Dekad% > = 1) & (%Dekad% < = 3)"
        File Open Image, " c:\ccd_af\1997\Dc97%Month%%Dekad%.af,,c:\data\projects\c.clr, 0,0,0,0"
Batch If Else
        File Open Image, "c:\ccd_af\1997\default.img,,c:\data\projects\c.clr, 0, 0, 0, 0"
Batch If End
```

The example above is an if-then clause delimited by the commands Batch If Begin and Batch If End. Here the variable %Dekad% is used to select the image that will be loaded. The first line checks that the value attributed to this variable is between 1 and 3. If the value is valid, the following line is executed by WinDisp 4.0, and Batch If Else is not executed. If the value is not valid, the Batch If Else is executed.

This statement can be useful in automatically adapting names of variables when an error is detected as in section 2.6.3. For example, if the variable %Month% must contain two digits to be valid, but the user enters only one digit (1 to 9 for the months January to September), the if-then statement will place a 0 before the digit to correct the entry:

```
Batch If Begin, "%Month%<10"
        Batch Variable Set, "MonthOK, 0%Month%"
Batch If Else, ""
        Batch Variable Set, "MonthOK, %Month%"
Batch If End, ""
```

After this evaluation, the variable %Month% is replaced by the variable %MonthOK% in the batch file and program processing.

With the help of if-then statements, expressions to evaluate variables can be written in a batch file. Some of the frequently used symbols are used in the following example:

```
Batch If Begin,"((%Dekad1%=1) & (Dekad2%=3)) | (%Month1%=%Month2%)"
    ...
Batch If End
```

Batch processing permits the execution of the command only if the variables %Dekad1% **and** %Dekad2% are equal to 1 and 3 respectively, **or** if the variable %Month1% is equal to the variable %Month2%. You will find a list of the symbols used in expressions of this type in section 2.6.8.

It is important to note:
- A special function @file ("name of file") can be put into an if-then statement to insure the existence of a file.
- An if-then expression may contain any kind of numeric character or space.
- The section Batch If Else is not absolutely required in an if-then statement, which can therefore function without execution by default.

2.6.5. For-next loops

To repeat the same command for a series of files (for example, the same type of image for different dates) the for-next loop can be adapted. The example below shows how a for-next loop is used to display images of three consecutive dekads:

```
Batch For Begin, "Dekad, 1, 3, 1"
    File Open Image, " c:\ccd_af\1997\Dc97%Month%%Dekad%.af,,c:\data\projects\c.clr, 0,0,0,0"
Batch For End
```

The part "Dekad, 1, 3, 1" signifies that the loop is repeated from the value of 1 to the value of 3, increasing successively by 1, and that these values are assigned to the variable %Dekad%. This variable is then used in the command to display the image.

Note that in for-next loops the value of the increment (the last parameter in the Batch For Begin line), can be negative, allowing you to have a command like the following:

```
Batch For Begin, "Dekad, 3, 1, -1"
    ....
Batch For End
```

This loop will load successively the dekad images from 3 to 1. The command executes the loops diminishing the value of the variable.

WinDisp 4.0 can execute loops placed within loops as well as within if-then statements. For example:

```
Batch For Begin, "LoopOut, 1, 5, 1"
    Batch For Begin, "LoopIn, 1, 10, 1"
        ....
    Batch For End
Batch For End
```

In this example LoopIn is included in LoopOut. As in the previous examples, indenting these commands improve the legibility.

2.6.6. Goto Label jumps

In certain cases, you will want to go from one location to another within a batch. A simple example would be if you ask the user if he wants to repeat the batch and display another image. The batch would resemble the following:

```
Batch Goto Name, "Loop_Begin"
....
....
Batch Variable Set, "Repeat to display another image? (y/n), n"
Batch If Begin, ""%Repeat%" = "y""
    Batch Label Goto, "Loop_Begin"
Batch If End
```

2.6.7. Batch files calling batch files

WinDisp 4.0 is capable of calling up one batch from another. Simply save a Batch Play command within a batch, and this batch will execute the other. For example, the following batch executes Mybatch.cmd, then requires the user to rerun the batch a second time:

```
Batch Label Define "Call_Start"
Batch Play "mybatch.cmd"
Batch Variable Prompt, "UserInput, Run mybatch again?, n"
Batch If Begin ""%UserInput%"="y"
        Batch Label Goto, "Call_Start"
Batch If End
```

It is important to note:
- All the variables in a batch are global, which means that all the variables created and used in a batch can also be used by the file that runs it, and by all the files the batch calls.
- A batch can call itself, but there is a risk of getting into an infinite loop.
- The jumps are not global and cannot be used from one batch to another.

2.6.8. Operators used in batch language

Parentheses must delimit each expression.

=	Equal to
>=	Greater than or equal to
<=	Less than or equal to
>	Greater than
<	Less than
<>	Not equal to
&	And
|	Or

2.7. Analysis

For all image analysis executed by WinDisp 4.0, you must supply maximum and minimum pixel values. By default the threshold values are 0-0; that is, they adapt automatically to the maximum and minimum values of the image. All pixel counts are included in the processing. To change the thresholds, use the command Process Thresholds. For details concerning this command, see Chapter 3.

2.7.1. File lists

Several functions of WinDisp 4.0 use a list of one or more files for entry. Use of a file list avoids manual entry of names of files. An ASCII file, with values delimited by commas, contains a list of file names with one name per line with headings for rows and columns. Here is an example of a file list used to graph pixel values in a series of images:

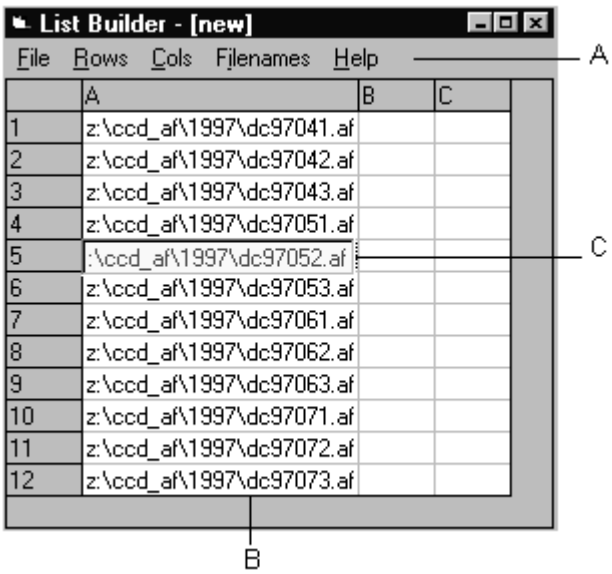
NDVI, 1996, Average
Jan, c:\img\dv9601.img, c:\img\dvm01.img
Feb, c:\img\dv9602.img, c:\img\dvm02.img
Mar, c:\img\dv9603.img, c:\img\dvm03.img

The functions using a file list are the following:
- Process Series: single-column for image names; row names not used
- Process Stats: single-column for image names; row names used as table fields
- File Open Film: single-column for names of bitmaps; row names used as title bar captions
- View Graph Image Series: multiple-columns for image names; row names used as X-axis labels
- View Graph Map Data: single-column for statistics filenames; row names used as curve labels

Consult Chapter 3 for more details concerning these functions.
To create a file list directly inside a batch, use the command Batch Build List.

A special dialog box has been created to facilitate creating and editing these file lists.

By clicking on the browse button of any dialog box, the file list editor appears for each parameter requiring a file list.



A. **File list editor Menu**

File

New	Create a new empty list, with number of rows and columns defined
Open	Open an existing file list
Save	Save the active list in the active file list
Save As	Save the active list in a new file list
Exit	Close the window for creating lists

Rows	
Edit names	Edit names of rows
Stop Edit Names	Exit the editor
Add	Add empty rows to the list
Remove	Remove the selected row from the list
Columns	
Edit names	Edit names of columns
Stop Edit Names	Exit the editor
Add	Add empty columns to the list
Remove	Remove the selected column from the list
Filenames	
Add	Select file names from the dialog box and insert them in the list
Remove	Remove selected filenames
Help	Open the Help file to the page treating file lists

B. **File lists**
This column is made up of a single file list which can be used to carry out statistics on the group of files listed.

C. **Editing**
The advantage of the file editor resides in the facility with which a list can be created or modified. The name of the list underlined in yellow can be directly changed, and the new list can be saved with the File Save or File Save As command.

2.7.2. Analysis of a series of images

This section, as well as the following two, presents the possibilities of using WinDisp 4.0 in the domain of seasonal analysis. The examples are adapted for the agricultural region of the Sahel, covering the period of April to November. In particular, an extracted sample of data and the presentation in the form of a graph is presented for Burkina Faso (see sections 2.7.3. and 2.7.4.).

Statistical analysis for time series can be done by WinDisp 4.0 for pixels in a series of images. The result will be presented in the form of an image in which each pixel is the result of applied analysis to the pixels in the same location in each of a series of images. The analysis can be performed for the following:

Max	Maximum value
Min	Minimum value
Avg	Average value
Median	Median value
Range	Range between the maximum value and the minimum value
Sum	Sum of the values
Count	Number of valid pixels (situated between the maximum threshold and the minimum threshold in a polygon
Stddev	Standard deviation of values
Decloud	Temporal smoothing technique
Slope	Slope of the trend line of the values
MaxDate	Date the maximum value occurs
MinDate	Date the minimum value occurs

To use each of these commands in the Process Series menu, you must supply WinDisp 4.0 with the following information: the name of the file list containig the list of images that you want analyzed, the location where you want to save the result of the analysis, and the name under which you want it saved. You will be asked to provide certain other parameters depending on the type of analysis done.

The commands Max, Min, Avg, Median and Range are generally applied to NDVI (Normalized Difference Vegetation Index) images, in order to observe vegetation peaks, the lowest values, average conditions, or differences between maximum and minimum values during a season. See examples

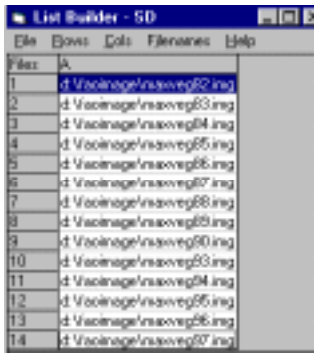
below. Min and Avg analysis exclude pixels having values corresponding to clouds or to an absence of data.

The command Sum is often used to create a cumulative image of CCD (Cold Cloud Duration) or ERF (Estimated Rainfall) time series for the growing period. See example below. To use the command Sum you must supply a multiplication factor. The pixels of an image resulting from this analysis will have values equal to the sum of the corresponding pixels in the images analyzed; the multiplication factor will restore pixel values to the image, enabling it to be compared with the images analyzed. The resulting image will then be displayed using the same color table as the original images. For example, a Sum carried out on five images will have a multiplication factor of 0.2.

The command Count produces an image in which each pixel has a value equal to the number of valid pixels situated in the same position in the images of the series. For the analysis of a series of 24 images, for example, a pixel value of 22 signifies that 2 pixels in the series were considered invalid. A pixel is valid when it is not contaminated by water, clouds, or the absence of data. This applies to NDVI images. See example below.

The command Stddev (standard deviation) is also frequently used to analyze NDVI images. It produces an image representing the variation of each pixel in a series of images. In the following example, this analysis has been applied to a series of images representing the annual maximum vegetation in the Sahel. These images have been produced using Max analysis for a series of NDVI images from the first dekad of April to the third dekad of November 1982 to 1997, excluding 1991 and 1992 because the satellite images were unusable after the eruption of Pinatubo.

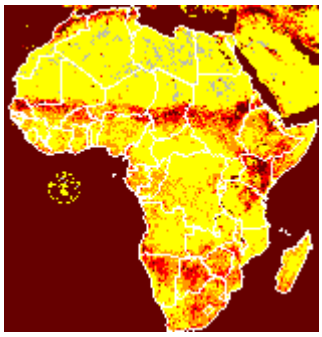
File list used is the following:



Color table used:

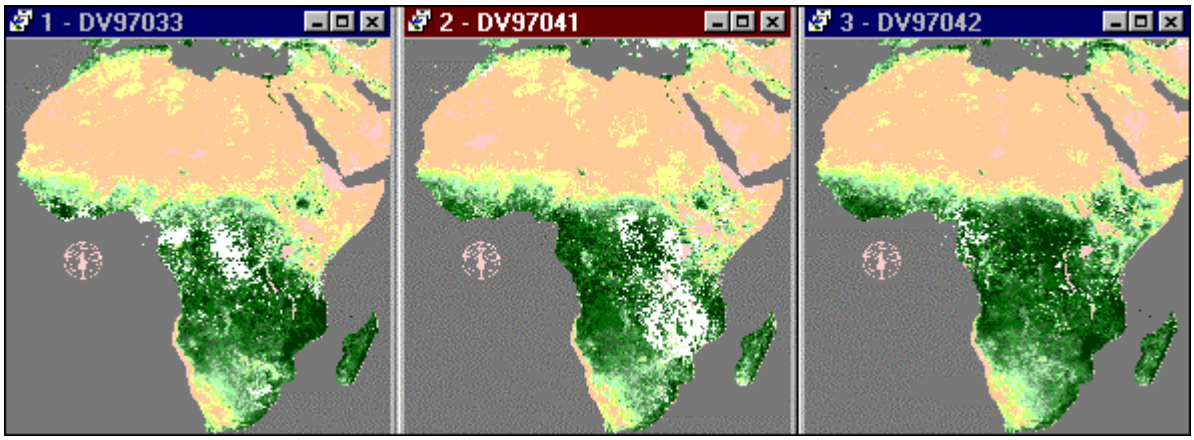
From	To	Red	Green	Blue	Color	Legend
1	10	255	255	0		< 1
11	15	255	150	0		1.0 - 1.5
16	20	255	0	0		1.5 - 2.0
21	25	180	0	0		2.0 - 2.5
25	255	100	0	0		> 2.5
0	1	192	192	192		Water

Image obtained:

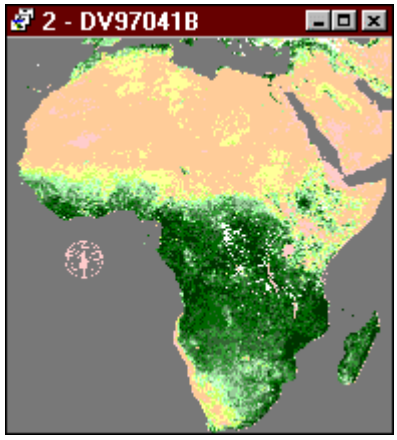


The command Decloud is an interpolation procedure used to eliminate the interference caused by clouds in NDVI images. To apply this command you must supply WinDisp 4.0 with the name of a filelist containing names of three NDVI images: the second image is the one to be corrected; the first and third are reference images that cannot contain clouds, at least in the area to be analyzed. You must also supply a percentage of negative deviation - 10% is used by default. This means that, if a pixel value in the second image deviates more than 10% from the average of the corresponding pixels of the first and third, then the pixel value of the second image will be replaced by this average.

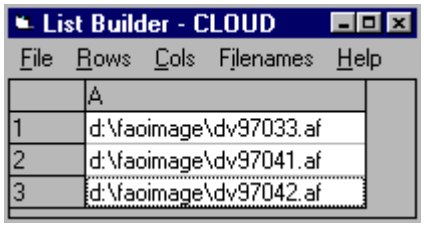
In the following examples, the clouds of image DV97041 can be eliminated by interpolation of images DV97033 and DV97042:



The image resulting from interpolation:



The file list used:



The Slope command is used to determine the slope of the values of each pixel in a series of images. The example below applies this to a series of NDVI images. For the Slope command you must enter a multiplication factor which increases the precision of the result. For example, if the multiplication factor is 1, a result equal to 100 for a given pixel indicates a null slope for the pixel; a result of 108 indicates a positive slope of 8%; and a result equal to 94 indicates a slope of negative 4%. If the multiplication factor is 10, the results for the same pixels would be 102, 184, and 38, increasing the precision of obtained results to +0.2%, +8.4%, and -3.8% respectively.

The commands DateMax and DateMin can be used on CCD images (Cold Cloud Duration) as well as NDVI, in order to determine the date of the peaks or the lowest values during a period. See the examples below. In the series of images in a file list, WinDisp 4.0 picks out, for each pixel, the image that contains the highest or lowest value, and assigns to the pixel the number of this image in the file list. For example, in applying DateMax to the series of images in one of the file lists below, if a pixel is found to have the highest value in image 'dc97043.af', this pixel will have the value '12' in the resulting image. To make the resulting image readable, it will be necessary to open an adapted color table such as the DATE table reproduced below.

The following images illustrate the various types of analysis available, except Stddev and Decloud already illustrated above. The images are produced from analysis on either CCD satellite images from April to November 1997 or NDVI images covering the same period. Consult section 2.7.1 for details on file lists.

List Builder - CCD

File Rows Cols Filenames Help

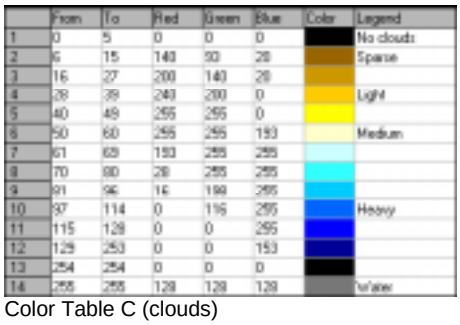
	A
1	d:\faoimage\dc97041.af
2	d:\faoimage\dc97042.af
3	d:\faoimage\dc97043.af
4	d:\faoimage\dc97051.af
5	d:\faoimage\dc97052.af
6	d:\faoimage\dc97053.af
7	d:\faoimage\dc97061.af
8	d:\faoimage\dc97062.af
9	d:\faoimage\dc97063.af
10	d:\faoimage\dc97071.af
11	d:\faoimage\dc97072.af
12	d:\faoimage\dc97073.af
13	d:\faoimage\dc97081.af
14	d:\faoimage\dc97082.af
15	d:\faoimage\dc97083.af
16	d:\faoimage\dc97091.af
17	d:\faoimage\dc97092.af
18	d:\faoimage\dc97093.af
19	d:\faoimage\dc97101.af
20	d:\faoimage\dc97102.af
21	d:\faoimage\dc97103.af
22	d:\faoimage\dc97111.af
23	d:\faoimage\dc97112.af
24	d:\faoimage\dc97113.af

List Builder - NDVI

File Rows Cols Filenames Help

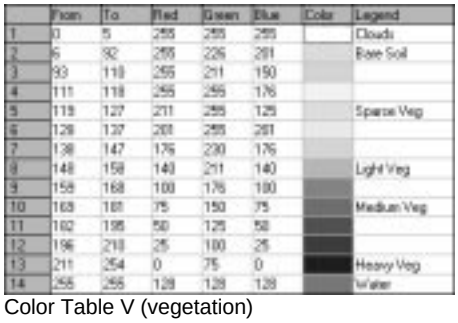
Files	A
1	d:\faoimage\dv97041.af
2	d:\faoimage\dv97042.af
3	d:\faoimage\dv97043.af
4	d:\faoimage\dv97051.af
5	d:\faoimage\dv97052.af
6	d:\faoimage\dv97053.af
7	d:\faoimage\dv97061.af
8	d:\faoimage\dv97062.af
9	d:\faoimage\dv97063.af
10	d:\faoimage\dv97071.af
11	d:\faoimage\dv97072.af
12	d:\faoimage\dv97073.af
13	d:\faoimage\dv97081.af
14	d:\faoimage\dv97082.af
15	d:\faoimage\dv97083.af
16	d:\faoimage\dv97091.af
17	d:\faoimage\dv97092.af
18	d:\faoimage\dv97093.af
19	d:\faoimage\dv97101.af
20	d:\faoimage\dv97102.af
21	d:\faoimage\dv97103.af
22	d:\faoimage\dv97111.af
23	d:\faoimage\dv97112.af
24	d:\faoimage\dv97113.af

The color tables used to open images resulting from these analyses (consult section 2.4.5 for details on color tables):



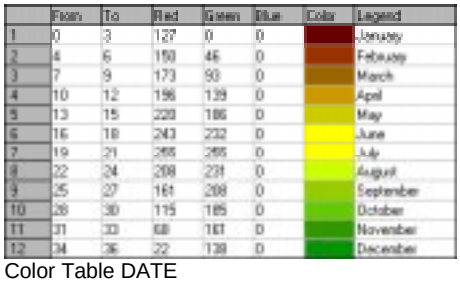
	From	To	Red	Green	Blue	Color	Legend
1	0	5	0	0	0		No clouds
2	6	15	140	90	20		Sparse
3	16	27	200	140	20		
4	28	39	240	200	0		Light
5	40	49	255	255	0		
6	50	60	255	255	153		Medium
7	61	69	153	255	255		
8	70	80	28	255	255		
9	91	96	16	199	255		
10	97	114	0	116	255		Heavy
11	115	128	0	0	255		
12	129	253	0	0	153		
13	254	254	0	0	0		
14	255	255	128	128	128		Water

Color Table C (clouds)



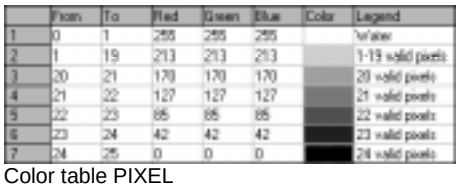
	From	To	Red	Green	Blue	Color	Legend
1	0	5	255	255	255		Clouds
2	6	92	255	226	201		Bare Soil
3	93	110	255	211	150		
4	111	118	255	255	176		
5	119	127	211	255	125		Sparse Veg
6	128	137	201	255	201		
7	138	147	176	230	176		
8	148	158	140	211	140		Light Veg
9	159	168	100	176	100		
10	169	181	75	150	75		Medium Veg
11	182	195	50	125	50		
12	196	210	25	100	25		
13	211	254	0	75	0		Heavy Veg
14	255	255	128	128	128		Water

Color Table V (vegetation)



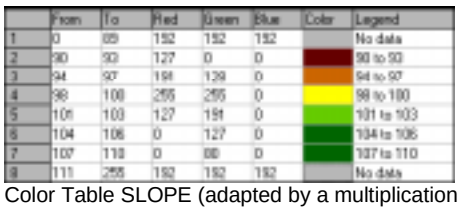
	From	To	Red	Green	Blue	Color	Legend
1	0	3	127	0	0		January
2	4	6	150	46	0		February
3	7	9	173	93	0		March
4	10	12	196	139	0		April
5	13	15	220	186	0		May
6	16	18	243	232	0		June
7	19	21	255	255	0		July
8	22	24	208	231	0		August
9	25	27	161	208	0		September
10	28	30	115	185	0		October
11	31	33	68	161	0		November
12	34	36	22	138	0		December

Color Table DATE



	From	To	Red	Green	Blue	Color	Legend
1	0	1	255	255	255		Water
2	1	19	213	213	213		1-19 valid pixels
3	20	21	170	170	170		20 valid pixels
4	21	22	127	127	127		21 valid pixels
5	22	23	85	85	85		22 valid pixels
6	23	24	42	42	42		23 valid pixels
7	24	25	0	0	0		24 valid pixels

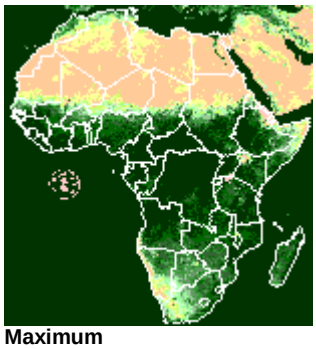
Color table PIXEL



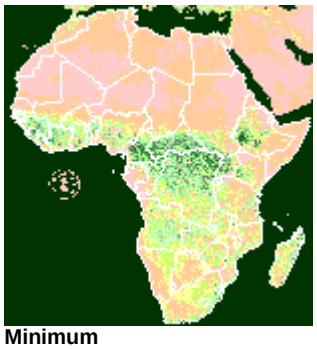
	From	To	Red	Green	Blue	Color	Legend
1	0	89	152	152	152		No data
2	90	93	127	0	0		90 to 93
3	94	97	191	129	0		94 to 97
4	98	100	255	255	0		98 to 100
5	101	103	127	191	0		101 to 103
6	104	106	0	127	0		104 to 106
7	107	110	0	88	0		107 to 110
8	111	255	192	192	192		No data

Color Table SLOPE (adapted by a multiplication factor = 1)

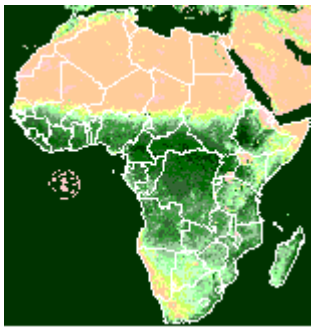
The type of images and the color table used for these analyses are indicated under each image:



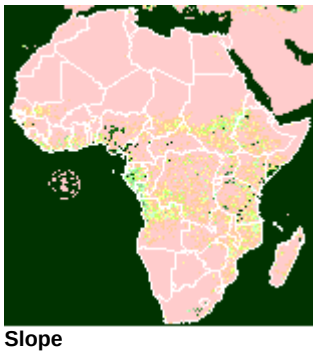
Maximum
Images NDVI - Color Table V



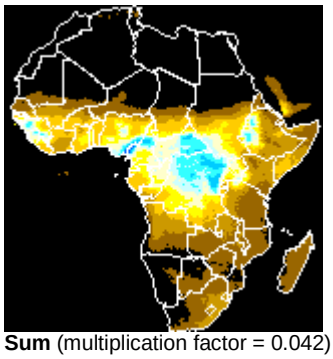
Minimum
Images NDVI - Color Table V



Average
Images NDVI - Color Table V

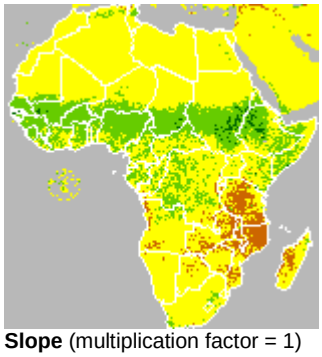


Slope
Images NDVI - Color Table V

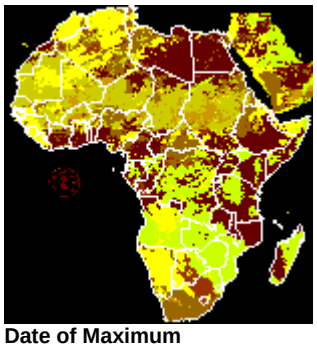


Sum (multiplication factor = 0.042)
Images CCD - Color Table C

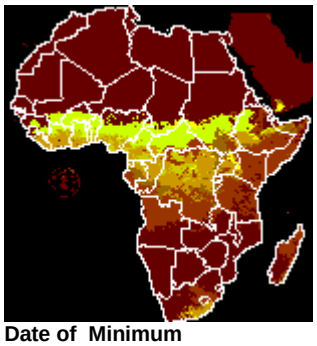
Count Pixels
Images NDVI - Color Table PIXEL



Slope (multiplication factor = 1)
Images NDVI -Color Table SLOPE



Date of Maximum
Images CCD - Color Table DATE



Date of Minimum
Images CCD - Color Table DATE

2.7.3. Process stats

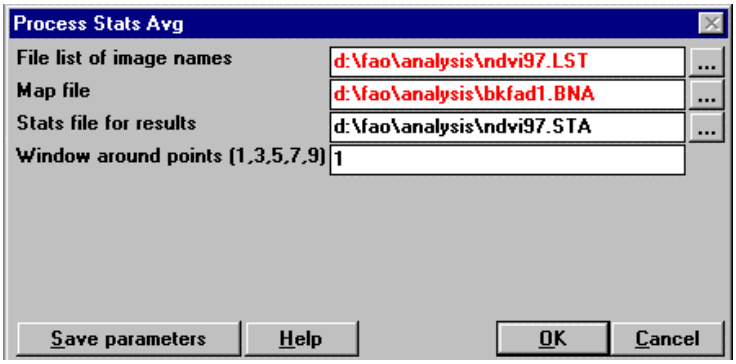
With the Process Stats menu, you can extract statistics for points and polygons within the images. The results will be in the form of an ASCII table which can be used to present the data in the form of a graph (section 2.7.4). The following commands are available:

Max	Maximum value
Min	Minimum value
Average	Average value
Median	Median value
Stddev	Standard deviation of values
Range	Range of values
Count	Number of valid pixels (between the maximum and minimum thresholds) in a polygon

The example described in the next two paragraphs analyzes the average of NDVI images from the first dekad of April 1997 to the third dekad of November 1997 in the agricultural regions of the Sahel. The statistics are extracted for the provinces of Burkina Faso. In order to obtain a point of comparison for the analysis of data obtained for 1997, the same analysis is conducted on NDVI images (16 years) covering the same period.

All of the other analyses available in this menu can be done in the same way as the analysis for averaging.

A dialog box similar to the one shown at the right will appear when Process Stats is run:



The following parameters must be supplied:

A. **File list of image names**
You must provide the file list (.LST) containing the names of all images that you want to include in the analysis. All the images in the list must have the same header window and projection parameters, because the map masks (pixels from which statistics are extracted) are calculated only for the first image. For more information of file lists, see Section 2.7.1.
Example of Burkina Faso: the first analysis is done using the file list presented in Section 2.7.2, which includes the period from April to November 1997. The second analysis uses NDVI average images (16 years) from April to November.

B. **Map file**
The statistics are calculated relative to a prescribed polygon. It is necessary to provide WinDisp 4.0 with the name of a correct geo-referenced map (.BNA) that can serve as the basis for statistical calculations.
Example of Burkina Faso: for each of the two analyses done, the boundary map of Burkina Faso is used as a feature reference. WinDisp 4.0 will calculate the average pixel values within the borders of each province of Burkina Faso for each image on the list.

C. **Stats File for results**
Location and name (.STA) must be given for the table of results.
Example of Burkina Faso: the two data tables resulting from the analysis of average NDVI images of 1997 and the 16-year average NDVI are named 'ndvi97.sta' and 'ndviavg.sta' respectively.

D. **Pixels around points (1,3,5,7,9)**
This parameter is used to define the area around a pixel (for example a meteorological station) which can be included in the analysis of the pixel.
Example of Burkina Faso: in the case of analysis linked to some polygons this parameter is not used, so its value by default is equal to 1.

The results of the extraction are stored in an ASCII format table. The first line identifies the fields derived from the first column in each line of the list file. Each row of the table begins with the name of the cartographic feature, delimited by quotation marks, followed by the data from each image, separated by a comma and a space.

Example of Burkina Faso: statistics table 'ndvi97.sta' (the following is data represented in a graph in section 2.7.4.):

"stats", "1", "2", "3", "4", "5", "6", "7", "8", "9", "10", "11", "12", "13", "14", "15", "16", "17", "18", "19", "20", "21","22","23","24"
"Oudalan", 0.10, 0.10, 0.10, 0.09, 0.07, 0.07, 0.06, 0.07, 0.06, 0.07, 0.11, 0.11, 0.14, 0.18, 0.21, 0.20, 0.16, 0.14, 0.12, 0.11, 0.12, 0.13, 0.13, 0.14
"Soum", 0.11, 0.10, 0.10, 0.09, 0.07, 0.07, 0.07, 0.08, 0.08, 0.09, 0.13, 0.14, 0.18, 0.22, 0.24, 0.25, 0.21, 0.18, 0.16, 0.13, 0.14, 0.14, 0.14, 0.14
"Seno", 0.12, 0.11, 0.11, 0.07, 0.08, 0.09, 0.07, 0.09, 0.07, 0.08, 0.13, 0.13, 0.14, 0.17, 0.20, 0.22, 0.23, 0.20, 0.18, 0.14, 0.13, 0.14, 0.14, 0.14

"Yatenga", 0.13, 0.13, 0.12, 0.12, 0.09, 0.10, 0.10, 0.14, 0.13, 0.14, 0.16, 0.18, 0.22, 0.23, 0.27, 0.30, 0.28, 0.23, 0.22, 0.17, 0.18, 0.18, 0.18, 0.17

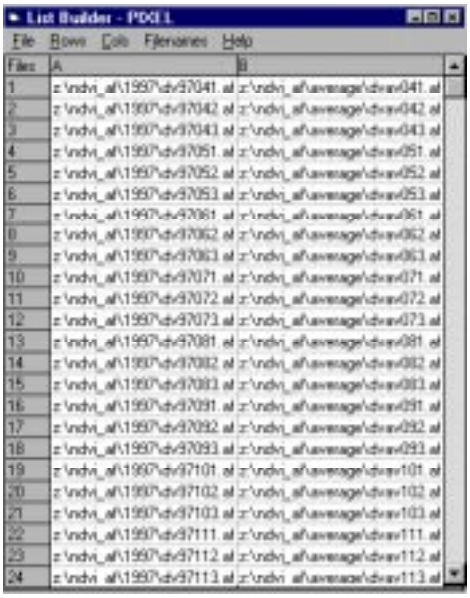
Up to 36 values can be stored in one row. By default, if more than half of the pixels in a polygon have a value outside the valid limits, -9999 will replace the extracted value from the polygon.

2.7.4. Viewing graphs

WinDisp 4.0 allows the graphical representation of different information, for example the results of the command Process Stats (described in section 2.7.3.) or information relating to a displayed image.

The command View Graph Image Series is used to display a graph of the evolution, in a series of images, of the values of a designated pixel. This pixel is selected with the cursor, clicking on it in the reference image previously displayed.

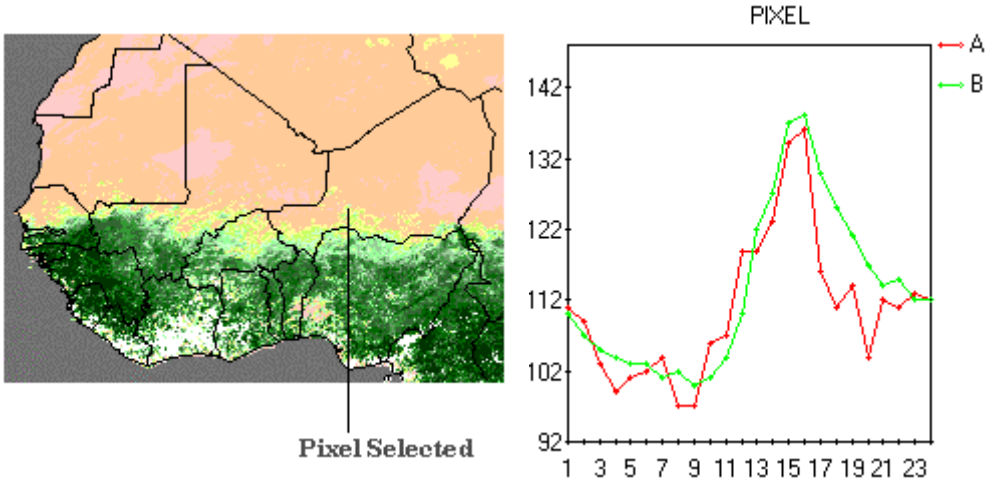
To activate the command View Graph Image Series open any image (it does not matter which image; the aim is simply to activate the function). To facilitate the selection of the pixels you want, it is recommended that you superimpose a map on the displayed image.



The parameter that you must supply next is the name of the file list containing the names of the images with the data you wish to graph. Open a window in which the graphs can be displayed by selecting the pixel on the map.

If you want to view two graphs at the same time for comparison, you must use a file list as seen on the right. This file list permits the display on the same graph, of the evolution of the values of the pixel selected, in the NDVI images for the period from April to November 1997, and in the NDVI averages (16 years) from April to November.

To display a graph in the new window, select the designated pixel on the image marking on the map that you have superimposed (Afrad1.bna). As you can observe in the illustration below the legend of the graph is set up from a file list.

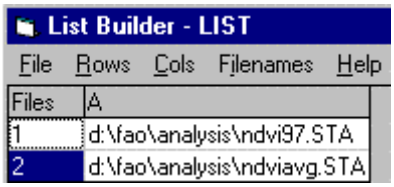


In this example, the red line (A) represents the evolution (April to November 1997) of the value of NDVI data for the selected pixel, while the green line (B) represents the 16 year NDVI averages for the same pixel.

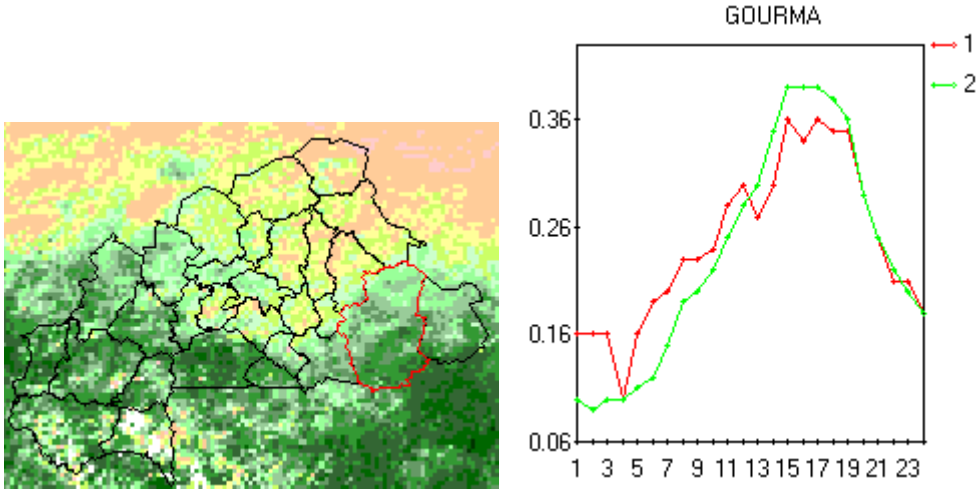
The command View Graph Map Data is used to display a graph showing the evolution, for a series of images, for values of a selected polygon; in other words, graphing the relative temporal data presented in a table in which the first column contains the names corresponding to the names of cartographic features of the map displayed. The data originates from the table of results from the analysis done with Process Stats (see Section 2.7.3).

To activate the command View Graph Map Data, open any image. Superimpose the map you want to work with using Retrieve Map. You must supply the name of the file list containing the name of the statistics file where you want to put the graph data. Open this in the window by selecting the polygon on the map.

Example of Burkina Faso: the file list used is this list of two statistics files obtained from the analyses done on the NDVI images of 1997 and the NDVI averages, 'ndvi97.sta' and 'ndviavg.sta' (see the beginning of the example in Section 2.7.3.).



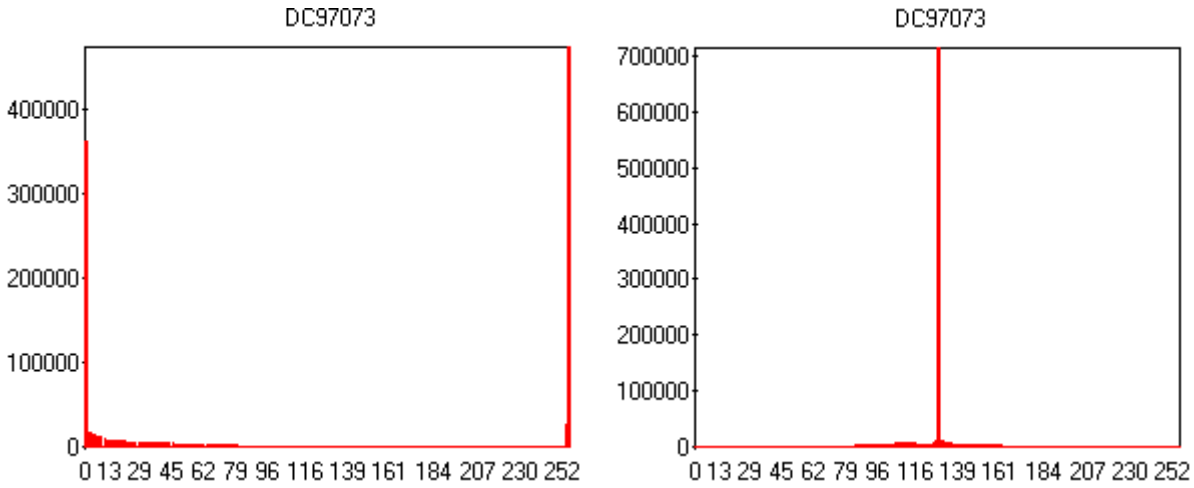
To display a graph of data in the new window, select the province on the reference map of Burkina Faso that you have superimposed on the image. As seen in the illustration below, a selected polygon appears in red; its name appears just above the graph, and the legend is set up through the file list.



In this example the red line (1) represents the evolution (April to November 1997) of the average NDVI data for the province of Gourma, while the green line (2) represents the 16-year NDVI average for the same province.

The command View Map Histogram is a function to display a histogram representing the number of pixels of an image, or of a difference image, having a value equal to each of the 256 possible pixel values.

The following graphs are obtained by this command for the satellite image of Africa for CCD for the third dekad of July 1997, and for the difference image between the first image and the one for the third dekad of November 1997:



In these graphs one can note that the images contain about 750 000 pixels; in the first graph these are divided mostly between very dry areas (pixel value=0) and ocean (pixel value=250). In the difference image the pixel values are mostly in the center of the color values (128) indicating that for the majority of the pixels, the two images used to calculate the difference image are similar.

2.7.5. Process SEDI

The objective of this command is to run Satellite Enhanced Data Interpolation (SEDI) routines.

The SEDI interpolation method was developed for the Regional Remote Sensing Project based at Harare (Zimbabwe). This routine interpolates rainfall data measured at ground level stations with CCD images received from the FAO Artemis Project. The method has also been applied to other parameters such as potential evapotranspiration (PET) and altitude, and agricultural yields and NDVI.

Despite certain deviations from the basic idea, the concepts of this interpolation method have been published in many different places. A comparable method, called "co-kriging", has been applied in many geological studies concerning groundwater. SEDI is an easily used method for "assisted" interpolation. It can be applied to any parameter for which values are available for a certain number of geographic stations, as long as there is a background which must have a negative or positive relation with the parameter to interpolate.

Three elements are required to insure complete success with the SEDI method:

- The availability of the parameter to interpolate in the form of associated data at some geo-referenced locations.
- The availability of a background parameter in the form of a regular grid for the same geographical area (for example, a digital image of CCD, NDVI, altitude).
- A relation between the two parameters (negative or positive: rainfall/CCD is positive, PET/altitude is negative). A Spearman rank correlation test can reveal whether a relation exists, and how strong this relation is.

The SEDI method produces, in the form of a field, the parameter to interpolate. The calculation can be influenced by setting a number of input parameters.

An example using rainfall and CCD

Rainfall data are gathered on a dekad (10-day) basis in many countries of the world. The geostationary METEOSAT satellite produces infrared temperature images of the earth every half-hour. In tropical regions it can be assumed that areas with temperatures lower than minus 40 degrees Celsius are covered with clouds. The cumulated number of hours in a

dekad with this low temperature is called "Cold Cloud Duration" (CCD), and is represented as an image. Each pixel of the image represents one data value, and can be assigned a color depending on the value. The relation between rainfall and CCD is positive. In other words, high rainfall values generally coincide with high CCD values.

The SEDI process is done in three steps:

1. Extracting values from the image at certain points, and calculating the ratio of point and image values
2. Creating a regularly spaced grid from the ratios
3. Multiplying the values of the grid by the values of the image to obtain an image with values of interpolated rainfall

Step 1: Extracting values from the image and calculating the ratio

For every point in the rainfall data, a value can be extracted from the CCD image. The SEDI method will find the pixel that coincides with a rainfall station and extract the pixel value. In some cases the value of one pixel does not give satisfactory results. Therefore SEDI allows the user to extract values of more than one pixel from the image, and take its average as the image value for the station.

The rainfall values are stored in an ASCII text file with the following format:

column 1: longitude of the point
column 2: latitude of the point
column 3: value of the parameter at this point
column 4: a label identifying the point

One can use either spaces or commas as separators between the columns. In this example the values are separated by commas.
Sample from a rainfall data file:

```
31.32,-17.78,31.1,"Arcturus"
30.40,-17.32,108.0,"Banket"
30.85,-18.27,78.4,"Beatrice"
30.00,-22.22,5.4,"Beitbridge"
27.33,-17.62,20.1,"Binga"
31.58,-21.02,7.8,"Buffalo-range"
31.43,-19.32,28.7,"Buhera"
```

For each station we now have a rainfall value and a CCD value. The Spearman rank correlation coefficient yields a positive value. This means the relation between rainfall and CCD is positive. All stations for which no values could be extracted (either because they lay outside the image window or the extracted values are missing) are eliminated from the output file. Therefore the output file may contain fewer lines than the input file. The ratio between rainfall and CCD value is now calculated and stored in an ASCII table with the following format:

column 1: longitude of the point
column 2: latitude of the point
column 3: calculated value of the ratio at this point
column 4: a label identifying the point
column 5: value of parameter at the point (provided in column 3 of the input file)
column 6: pixel value extracted from the image

Columns 5 and 6 are not necessary for the creation of the SEDI image. However, they provide background information to the user and make it possible to change the file manually to eliminate undesirable side effects. As an example, rainfall values equal to zero result automatically in a ratio of zero. In most cases this result is satisfactory, but a user might want to change that to a low value (e.g.1), to make rainfall estimates higher than zero in the vicinity of a rainfall station for which the value is zero.

Sample output file:

```
31.32,-17.78,1.0950704,"Arcturus",31.1000000,28.4000000
30.40,-17.32,2.5000000,"Banket",108.0000000,43.2000000
30.85,-18.27,1.6333333,"Beatrice",78.4000000,48.0000000
30.00,-22.22,0.1310680,"Beitbridge",5.4000000,41.2000000
27.33,-17.62,0.4527027,"Binga",20.1000000,44.4000000
31.58,-21.02,0.3145161,"Buffalo-range",7.8000000,24.8000000
31.43,-19.32,0.9695946,"Buhera",28.7000000,29.6000000
```

Step 2: Creating a regularly spaced grid from the ratios

The second step is to create a grid from the irregularly spaced ratios. The ratio grid is created with the inverse distance method with a weighting power of 2.

The software allows the user to set:

- The distance between the grid lines. A small distance creates an accurate, dense grid, while a high value creates a coarse, less accurate and more general grid.
- The number of stations per gridpoint determines the number of stations included in the calculation of a point in the grid matrix.
- The maximum radius for interpolation determines whether a value is calculated for a point in the grid matrix. If the number of stations around this gridpoint within this radius is higher than the specified number of stations, a value is calculated. Otherwise the gridpoint is assigned a missing value, and the resulting image will be 'empty' at that particular point.

Step 3: Creating the SEDI image

The third step is to create the SEDI image. The process is simple. By multiplying the grid obtained in Step 2 by the background image, an estimate of the interpolated value to interpolate is obtained. For the rainfall and CCD data, a rainfall image is obtained by multiplying the values of the ratio grid by the values of the CCD image.

Some remarks concerning the image created:

- The SEDI image has the same width, height and pixel size as the background image.
- For a grid that has been created with Surfer, pixels falling outside the grid boundaries will be assigned a missing value. The extent of the grid is determined while creating it in Surfer. In this case, the grid automatically covers the whole image due to the use of the IGT (a supplied program - see the information below) gridding routine.
- Pixels that were missing in the background image will have a missing value in the SEDI image as well.
- Pixels that have a calculated value that falls outside the defined data range, (in this case 0-253) will be assigned missing values.

Automated processing

The command Process SEDI Automatic can be used to perform all three steps at once.

The command Process SEDI Assisted also performs the three steps automatically, and it also estimates values for most of the parameters. The estimated values are saved in a file (assist.ini) and can be used as a starting point for more refined calculations. This file is automatically displayed in WinDisp 4.0 after processing has been completed.

The SEDI software

The SEDI methods are incorporated in a DOS software package called DOS IGT (IDA GIS Tools). This package is freeware and can be downloaded from the FAO FTP site: FTP://FTP.FAO.ORG/SDRN/IGT/

The IGT manual describes the SEDI process in much more detail and is available at the same ftp site.

2.7.6. Modification of an image

There are many manipulations that can be applied to change the content or the presentation of an image.

The following is a list of the available functions. For explanations concerning the use of these functions, refer to Chapter 3.

Process Images Algebra
Perform algebraic operations on pixels of one or more images
Process Images Compress
Compress images to reduce their size
Process Images Window
Extract a window from an image
Process Images Filter
Apply a spatial filter for smoothing (maximum, minimum, average or median)
Process Images Difference
Subtract one image from another
Process Images New
Create a new, blank image
Process Images Paste
Paste one image on another
Process Images Map
Fill image pixels within map polygon boundaries
Process Images Mosaic
Combine a series of images to create a unique image

Process Header
View/Edit an image header
Process Header Changer Value
Modify a value of a variable in an image header

Reproject
Convert the projection of an image

2.7.7. Importing and exporting

With WinDisp 4.0 you can import images, maps and color tables, and convert them into a format which can be used in WinDisp 4.0, e.g., IDA format for images, BNA for maps, and ASCII files for color tables. You can also export images and maps in different formats.

Users should remember that WinDisp 4.0 operates ONLY with 8-bit images and that care must be taken when users are importing 16-bit images from other systems when using the Process Import Binary Image function. When importing 16-bit images, the correct slope and intercept (offset) values must be applied, if necessary, in order to scale the 16-bit file pixel values (which can range from -32767 to 32767) to the 8-bit 0 to 254 range.

Likewise, when exporting an 8-bit image to another system, care must be taken to apply the correct scaling factors, if necessary, in order to maintain the correct values for the image. These parameters [slope (m) and intercept (b)] can often be obtained from the WinDisp image header using the Process Header Edit function. If specialized formats are being exported (i.e. ARTEMIS type 13), the scaling factors (m and b) for the different type of images supported by WinDisp 4.0 are provided in section 4.1.3 of this manual.

The following is a list of the available functions. For detailed explanations of the use of these functions, refer to Chapter 3.

Process Import Table Ida
Convert an IDA .LUT color table to a WinDisp 4.0 color table
Process Import Ascii Image
Import an ASCII text file as an image
Process Import Binary Image
Import a raw binary '8-bit' or '16-bit' image
Process Import Erdas Image
Import an ERDAS 7.x .LAN or .GIS image
Process Import Erdas Table
Convert a .TRL color table ERDAS 7.x .GIS to a WinDisp 4.0 color table
Process Import Idrisi Image
Import an IDRISI image
Process Import Idrisi Vector
Import an IDRISI vector map file
Process Import Surfer Grid
Import a Surfer raster grid
Process Import Surfer Plot
Import a Surfer Plot file as a .BNA map
Process Import ArcView Shape
Import an ESRI ArcView Shape file as a .BNA map

Process Export Ascii Image
Export an image as an ASCII text file
Process Export Binary Image
Export an image as raw binary '8-bit' image
Process Export Erdas Image
Export an image in ERDAS 7.x .LAN or .GIS format
Process Export Idrisi Image
Export an image in IDRISI format
Process Export Idrisi Vector
Export a .BNA map as an IDRISI vector
Process Export Surfer Grid
Export an image to a Surfer raster grid
Process Export Surfer Blank
Export a .BNA map to a Surfer blank file
Process Export ArcView Shape
Export a .BNA map to an ESRI Shape file

2.8. On-screen digitizing

WinDisp 4.0 permits the on-screen digitization of points, lines and polygons over maps and images in a display window. The resulting map can be saved as a .BNA map file (cfr. § 4.4.).

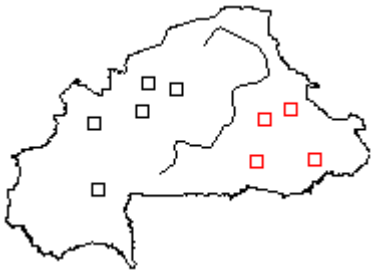
The menu functions Draw Map Point and Draw Map Line can be used to create new .BNA map files or to finalize and/or update existing files, such as maps of cities or rainfall stations (point), or roads (lines). The menu function Draw Map Region can be used to define new polygons or zones which can then be saved in a .BNA map file such as crop zones or anomalous areas. These files can then be used like any other .BNA files for display and extracting statistics from and image or series of images (cfr. § 2.7.3.).

In order to precisely digitize points, line and/or polygons it is necessary to open an image and/or map file as a reference background, as is done with a map file in the example presented here for Burkina Faso:

In the dialog boxes for the menu functions Draw Map Point, Draw Map Line and Draw Map Region the user is prompted for the .BNA filename and the path in which to save the new map information, the map color to use for the new features being digitized, as well as the primary and secondary feature name to attribute to the new feature for the .BNA file format.

To add new features to an open or existing .BNA map file, the user can respond positively (y) to the question "Append if file exists (y/n)?". Only one feature type can be contained in a single .BNA file therefore a file can ONLY consist of either points, lines or polygons and can not contain mixed features. Also, only like features can be appended to an existing or open file.

To digitize a single point, simply double click the left mouse button at the location you wish to digitize the point. To digitize multiple points with the same primary and secondary feature names (as done with the groups of points shown in the Burkina Faso example to the left) single click all points at the correct location and save the feature as one cartographic object by double clicking the last point.



To digitize a line, start the line by clicking the left mouse button at the desired location, then continue clicking along the desired line feature, correctly placing the points as required to correctly represent the desired line, and finish digitizing the line by double clicking the left button at the last point on the line.

To digitize a polygon (region), proceed as for a line. The polygon will be closed when the last point is confirmed by double clicking the left mouse button.

The file structure for the point file used in the example above which contains two series of point features, and uses the .BNA format containing the following information: “primary feature name”,“secondary feature name”,1,longitude,latitude (cfr. § 4.4.), and would look as follows:

```
"Point","1",1,-3.602792,12.51693
"Point","1",1,-2.563538,12.77675
"Point","1",1,-2.433631,13.42628
"Point","1",1,-1.816574,13.2639
"Point","1",1,-3.537838,11.08796
"Point","2",1,.0995504,12.61436
"Point","2",1,-.0953097,11.70502
"Point","2",1,1.171281,11.76997
"Point","2",1,.6516541,12.8417
```

2.9. Stand alone processing

A separate utility (WP4DOS.EXE) is included which permits executing all the functions from DOS commands. This allows users to create batch treatment for images under DOS or Windows without having to call WinDisp 4.0. The parameters of this program are exactly the same as if they were situated in the batch, and are written in quotation marks and separated by commas, after the name of the function followed by a comma:

```
wp4dos <Function>, <"Parameters">
```

Limitations

DOS has a limitation of 128 characters on the command-line. Therefore, the entire command-line for WP4DOS must not exceed this limitation.

Command files

Multiple functions can be executed within a single WP4DOS session by putting them on successive lines in an ASCII command file and calling that file as follows: WP4DOS <command file>

Abbreviations

Process Series Avg can be written P S A to save space.

2.10. Programming with .DLL

All the functions for treating images are located in a single file .DLL (WP4.DLL). Experienced programmers can write their own Windows programs to process images by calling the functions from .DLL. The subroutines and statement types are available in .DLL and are presented as written in Visual Basic.

DLL Calls

Subroutines which must be called before calling any other subroutine:

```
Declare Sub ProcessRunAwaySetup Lib "wp4.dll" (ByVal pichWnd As Integer, ByVal btnHwnd As Integer)
```

Subroutine used to call any other processing function (except function headers described below):

```
Declare Sub ProcessFunction Lib "wp4.dll" (By Val OptionFunction$, By Val OptionParameters$)
```

OptionFunction and OptionParameters are processing functions and their associated parameters, which appear exactly as they appear in a batch file.

The following statement, in Visual Basic, is for a header image:

```
Type Header Type
    Title As String
    ImageType As Integer
    Projection As Integer
    Height As Integer
    Width As Integer
    LatCenter As Double
    LongCenter As Double
    XCenter As Double
    YCenter As Double
    DX As Double
    DY As Double
    Parallel1 As Double
    Parallel2 As Double
    Lower As Integer
    Upper As Integer
    Missing As Integer
    Slope As Double
    Intercept As Double
    Decimals As Integer
End Type
```

Statements allowing manipulation of Header Images

```
Declare Function ProcessHeaderLoad Lib "wp4.dll" (s As HeaderType, By Val FileName As String) As Integer
Declare Sub ProcessHeaderSave Lib "wp4.dll" (s As HeaderType, ByVal FileName As String)
```

3. Command reference for WinDisp 4.0

This chapter contains detailed information on the functions and commands available in WinDisp 4.0, including its purpose and use, the parameters required, and a description of the output.

The chapter is based on the WinDisp help file created by Eric Pfirman. The commands are listed in this chapter in the same order they appear in WinDisp 4.0.

3.1. Main menu

File	Open, close, save, print files or exit
Edit	Cut, copy, paste, undo, etc.
View	Zoom and pan images, and view graphs
Draw	Add points, lines, text, etc. to graphics
Batch	Store menu operations and play them back
Options	Set a variety of display window options
Process	Image processing functions
Window	Tile, cascade, minimize windows, etc.
Help	Open this help file, or an about box

3.2. Quick reference

The listing below provides a quick reference to the commands available in WinDisp 4.0. Details of each of the WinDisp 4.0 menu items are provided in sections 3.3 through 3.11 of this chapter.

File Menu

Open	**Open a new window and display the selected object**
Image	WinDisp or IDA image
Map	IDA or Atlas .BNA map
Bitmap	Bitmap graphic
Text	ASCII text file
Table	Comma-delimited ASCII table
Film	A series of Windows .BMP graphics displayed in succession
Project	WinDisp project
Idrisi Image	Idrisi binary image
Idrisi Vector	Idrisi vector map
Erdas Image	ERDAS 7.4 .LAN or .GIS image
ArcInfo Gen	ArcInfo .GEN arc or point map
ArcView Shape	ArcView .SHP shape map

Retrieve	**Add the selected object to the active window**
Image	WinDisp or IDA image
Bitmap	Bitmap
Map	IDA or Atlas .BNA map (use this to overlay maps on images)
Text	ASCII text file
Idrisi Image	Idrisi binary image
Idrisi Vector	Idrisi vector map
Erdas Image	ERDAS 7.4 .LAN or .GIS image
ArcInfo Gen	ArcInfo .GEN arc or point map
ArcView Shape	ArcView .SHP shape map

New	**Open a new, empty window of the selected data type**
Project	WinDisp project
Bitmap	Graphic (can be used to display images, maps, graphics, etc.)
Text	ASCII text (can also be used for color tables, data files, projects, etc.
Close	**Close the active window**
Close All	**Close all open windows**
Save	**Save the active window to a file of the selected data type**
Project	WinDisp project
Bitmap	Bitmap graphic
Text	ASCII text
Print	**Send one or all windows to the printer**
Print Current Window	Print the active text or graphic window
Print All Windows	Print all windows on a single page
Print Setup	Select a printer
Run	**Run an external application**
Exit	**Exit WinDisp**

Edit menu

Undo	Undo the previous operation
Cut	Cut a portion of a graphic or text to the clipboard
Copy	Copy a portion of a graphic or text to the clipboard
Paste	Paste contents of the clipboard to a window
Delete	Delete a portion of a graphic or text

View menu

Zoom	**Zoom in/out on an image or bitmap in the active window**
In	Zoom in by selecting a region with the cursor
Out	Zoom out to twice the current zoom factor
Previous	Zoom to the previous image coordinates
Image	Zoom to the full extent of the image or bitmap
Feature	Zoom in on a selected map feature
Lat/Long	Zoom in to area specified by latitude/longitude
Pan	**Change image display up, down, left or right**
Up	Move up the image 3/4ths the height of the window
Down	Move down the image 3/4ths the height of the window
Left	Move left in the image 3/4ths the window of the window
Right	Move right in the image 3/4ths the width of the window
Graph	**Display a graph of the specified type**
Image Series	Time-series for pixels selected by the cursor
Map Data	Tabular data for map features selected by the cursor
Histogram	Histogram of image pixel values
Redraw	**Redraw the active window**

Draw menu

Point	**One or more points**

Line	**A line with 2 or more vertices**
Region	**A close polygon**
Box	**A rectangle which may be filled**
Text	**Text of a specified font and color**
Fill	**Fill a polygon, rectangle, etc.**
Labels	**Map feature names**
Legend	**A legend**
From Existing File	A legend created from an existing colortable or legend file
Equal Intervals	Create a legend with equal intervals
Unique Values	Create a legend with unique values from the map data file
Percentiles	Create a legend using percentile classes
Quartiles	Create a legend with quartile (4) intervals
Logarithmic	Create a legend with logarithmic intervals
Colorbar	**A colorbar created from an existing colortable**
Bitmap	**A bitmap**
Map	**Digitize a point, line or region (polygon) on the screen**
Point	Digitize a point on the screen
Line	Digitize a line on the screen
Region	Digitize a region (polygon) on the screen

Batch menu

Record	**Record menu operations for later playback**
Play	**Play back previously recorded menu operations**
Debug	**Play back recorded batch file one line at a time**
Stop	**Stop recording or playing batch file**
Edit	**Edit a batch file in a text window**
Variable	**Assign values to batch variables**
Set	Assign a value to a variable
Prompt	Ask user for a value for a variable
(List)	(*This function is under construction*)
If	**Create a conditional if-then clause**
Begin	Beginning of section to evaluate if clause is true
Else	Section to evaluate if clause is false
End	End of the clause
For	**Create a for-next loop**
Begin	Mark the beginning of the loop
(Each)	(*This function is under construction*)
End	Mark the end of the loop

Label	**Set up a goto jump and a label to go to**
Goto	Start of a goto jump
Define	End of a goto jump
Pause	**Pause the batch file execution**
Build List	**Build an image list for processing functions**

Options menu

Display	To set various display-related options
Project	Set various options related to Projects
Edit Color Table	Edit/Modify a map or image color table
Edit Legend File	Edit and/or modify a legend file
Define Window Size	Define a default sub-window size (or maximize)
Communications	File-based communications link to other program

Process menu

Series	**Image time-series statistics for each pixel in the images**
Max	Maximum value
Min	Minimum value
Avg	Average value
Median	Median value
Range	Range of values
Sum	Sum of values
Count	Number of valid pixels
Stddev	Standard deviation of values
Decloud	Temporal smoothing technique
Slope	Slope of trend-line of values
MaxDate	When the maximum value occurs
MinDate	When the minimum value occurs
Images	**Various image-processing functions**
Algebra	Pixel algebra on one or more images
Compress	Compress images to reduce overall size
Window	Extract a window out of an image
Filter	Max, Min, or average spatial filter for smoothing
Difference	Subtract one image from another
New	Create a new, blank image
Paste	Paste one image on top of another
Map	Fill image pixels within map polygon boundaries
Mosaic	Combine a series of images into a single image
Stats	**Extract statistics from images for map features**
Max	Maximum value
Min	Minimum value
Avg	Average value
Median	Median value
Stddev	Standard deviation of values
Range	Range of values
Count	Number of valid pixels
Header	**View/Edit an image header**
Edit	View and edit an image header
Change Value	Change a single value in an image header
Threshold	Set upper and lower threshold for valid image values

SEDI	**Satellite Enhanced Data Interpolation routines**
Automatic	Automatically create interpolated image
Assisted	Automatically create interpolated image using default parameters
Step 1. Ratio File	Calculate pixel / parameter ratios
Step 2. Grid	Interpolate a Surfer grid file of ratios from the ratio file
Step 3. Image	Create an image of estimated values from gridded ratios and pixel values

Import	**Import image, maps and color tables**
IDA Luts	Convert IDA lookup table to WinDisp color table
Ascii Image	Import ASCII text file as an image
Binary Image	Import raw binary 8-bit image
Erdas Image	Import Erdas 7.4 LAN or GIS image
Erdas Trailer	Convert an ERDAS 7.4 GIS trailer to a WinDisp color table
Idrisi Image	Import Idrisi image
Idrisi Vector	Import Idrisi vector map file
Surfer Grid	Import Surfer raster grid
Surfer Plot	Import Surfer plot file as .BNA map file
ArcView Shape	Import ESRI ArcView Shape file as a .BNA map file

Export	**Export images and maps**
Ascii Image	Export image to ASCII text file
Binary Image	Export image to raw, binary 8-bit image
Erdas Image	Export image to Erdas 7.4 LAN or GIS
Idrisi Image	Export image to Idrisi format
Idrisi Vector	Export .BNA map to Idrisi vector map file
Surfer Grid	Export image to Surfer raster grid
Surfer Blank	Export .BNA map file to a Surfer blanking file
ArcView Shape	Export .BNA map file to an ESRI Shape file

Reproject	**Convert the projection of an image**

Window menu

Cascade	Cascade all open windows
Tile Horizontally	Fit all open windows down the main window
Tile Vertically	Fit all open windows across the main window
Arrange Icons	Arrange all icons across the bottom of the main window
Select	Select a window to make the active window
Define	Open and tile multiple windows within the main window

Help menu

Contents (F1)	Open this help file
About...	Display version information, etc.

3.3. File Menu

File Open Image
File Retrieve Image

Purpose
Display a WinDisp 4.0 image in a new window or retrieve an image into the current graphic window.

Parameters
Image file
Difference image file
Color table
Image X1 (0=default)
Image Y1 (0=default)
Image X2 (0=default)
Image Y2 (0=default)

Remarks
Use File Open Image to display an image in a new window and File Retrieve Image to display an image in the currently active graphic window.

The difference image file is optional. 0's for all image coordinates can be used to default to the entire image. The image will be scaled to fit the window. There is no longer a zoom factor; infinite, floating-point zoom is used. See the IDA Users Manual "IDA for DOS v.4.2 - Image display and analysis", FAO 1996 (SD:GCP/INT/578/NET Technical report) for a description of IDA file formats. See color tables for a description of color tables and how to create them.

An image should be retrieved before any maps. Also, retrieving more than one image into a window should be avoided.

File Open Map
File Retrieve Map

Purpose
Display a map in a new window, retrieve a map into the currently active window, or overlay a map on top of an image, bitmap or map in the currently active window.

Parameters
Map file
Map line color
Map line style
Map fill color
Map fill style
Data file (optional)
Data field (optional)
Data color table (optional)

Remarks
Use File Open Map to display a map in a new window. Use File Retrieve Map to either retrieve a map into the currently active window if it is empty, or to overlay a map on top of an image, bitmap or other map in the currently active window.

The vector map formats that can be used in WinDisp 4.0 are the .BNA (ATLAS*GIS Strategic Mapping ASCII), .SHP (ESRI Shape file), .VEC (IDRISI vector file) and .GEN (ungenerated ArcInfo coverages). See the IDA Users Manual and/or ATLAS*GIS or ESRI reference materials for a description of those file formats.

The data file and data field parameters are optional. If they are included, the data file must be an ASCII, comma-delimited file with field descriptors in the first row and map labels in the first column. All

data values must be numeric. The legend is only used if data is displayed. If a color table is specified, it will be used to assign colors to ranges of data values. This will over-ride the map fill color. If no color table is specified, the data be displayed in 5 equal ranges in colors from red to green.

Once a map has been displayed, the map label for points and polygons will be displayed in the status bar by clicking on the feature. If data has been displayed, the data value for that feature will also be displayed.

File Open Bitmap
File Retrieve Bitmap

Purpose
Display a bitmap in a new window or retrieve a bitmap into the current graphic window.

Parameters
Bitmap file
X1 (0=default)
Y1 (0=default)
X2 (0=default)
Y2 (0=default)
X1 (0=default)
UL Map X,Y (optional)
LR Map X,Y (optional)

Remarks
This can be used for displaying raster bitmap graphics in a variety of formats, including .BMP, .EPS, .JPG, .PCX, .RAS, .TGA, .TIF, .WMF, .WPG. Currently, .GIF format bitmaps are not supported because we do not have a license from Unisys.

Use X1, Y1, X2 and Y2 to display just a portion of a bitmap.

If the UL and LR map coordinates for the entire bitmap are specified, maps can be overlayed on top of the bitmap and the cursor will return map coordinates. Note that the bitmap must be in the same projection as the maps to be overlayed (ie lat/long projection).

The View Zoom functions can be used to zoom in and out on bitmaps.

WARNING: 256 color bitmaps will take over the display palette and destroy the palettes of any images displayed!

File Open Text
File Retrieve Text

Purpose
Display an ASCII text file in a new window or retrieve text into the currently active window.

Parameters
Text file

Remarks
Use File Open Text to open a text file into a new window. Use File Retrieve Text to retrieve a text file into a currently active text window. The retrieved text will be added at the current cursor position.

This is useful for editing and viewing projects, data files and color tables.

File Open Table

Purpose
Display a comma-delimited ASCII table.

Parameters
Comma-delimited ASCII table

Remarks
Simple ASCII, comma-delimited tabular data files can be displayed in a gridded window with this function. The first row should contain comma/quote-delimited field names and the first item in each successive row should contain a quote-delimited row name.

This function is useful for viewing image statistics files created with Process Stats or any other data file that is quote/comma-delimited in ASCII format. If the row names correspond to map features, then the values can be graphed with View Graph MapData and individual values can be overlayed on a map or image with Draw Labels.

The following is a sample data file:

```
"NDVI","JAN","FEB","MAR"
"GABON", 0.42, 0.43, 0.46
"UGANDA", 0.27, 0.23, 0.29
"CONGO", 0.35, 0.38, 0.42
```

File Open Film

Purpose
Display a series of images in rapid succession.

Parameters
File list of bitmap names

Remarks
See File-name list files for information on how to create a file-name list file.

Film loops are a powerful way to view change over time. To create a film loop, first display the images that you want to view and create a series of bitmaps (which can be done using File Save Bitmap). Next create a list of the bitmap file-names and then display the loop with this function. A variety of commands are available to control the display of the film loops. All film commands will be listed on the status bar when filming begins.

Filming has two modes of operation...

Automatic Mode
Filming starts in "automatic" mode. Each picture is shown for half a second by default. You can manipulate the animation with the following commands.
"F" – Fast: increases the speed of the animation by 1/10th of a second.
"S" – Slow: slows down the animation speed by 1/10th of a second.
"Q" – Quit: stops all filming, leaving the current image in the window
"M" – Manual: switches from Automatic to Manual mode.

Manual Mode
Manual mode allows you to switch between frames manually, allowing for closer inspection of individual pictures. Each frame is shown until you manually advance to the next frame, or until you return to Automatic mode.
"N" – Next: advances to the next frame
"P" – Previous: advances to the previous frame
"A" – Automatic: returns to Automatic mode.
"Q" – Quit: stops all filming, leaving the current image in the window.

File Open Project

Purpose
Open a WinDisp project in a new window.

Parameters
Project file
Number of windows across
Number of windows down

File Open Idrisi Image
File Retrieve Idrisi Image

Purpose
Display an IDRISI image in a new window or retrieve an Idrisi image into an existing window.

Parameters
Idrisi image file
Image X1 (0=default)
Image Y1 (0=default)
Image X2 (0=default)
Image Y2 (0=default)

Remarks
Use File Open Idrisi Image to display an Idrisi image in a new window, or File Retrieve Idrisi Image to display an Idrisi image in the currently active window.

This works with binary byte, integer and single IDRISI images. Image coordinates can be specified to display just a portion of the image. All of the View Zoom and View Pan functions can also be used to display a portion of the image. If the associated DOC file contains projection information, maps can be overlayed on top of the image and cursor coordinates will be displayed.

At this time, only the default 16-color IDRISI palette is used when displaying Idrisi images.

File Open Idrisi Vector
File Retrieve Idrisi Vector

Purpose
Display an Idrisi vector map in a new window, retrieve an Idrisi vector map into the currently active window, or overlay an Idrisi vector map on top of an image, bitmap or map in the currently active window.

Parameters
Idrisi vector file
Line color
Line style
Fill color
Fill style

Remarks
Idrisi vector files can be displayed in a new window the same way as WinDisp 4.0 map files with File Open Idrisi Vector. They can also be overlayed on top of images, bitmaps and other maps with File Retrieve Idrisi Vector if the maps are in a lat/long projection.

The Idrisi vectors are stored in a simple ASCII file format. Each feature within the file begins with a line containing a feature ID followed by the number of vertices in the feature. If the last vertex is the same as the first vertex, the feature is assumed to be a polygon. The file should end with two zeros.

Sample point file:

```
1 1
32.3 10.5
2 1
37.5 12.7
3 1
34.1 11.6
0 0
```

Sample line file:

```
1 3
32.3 10.5
37.5 12.7
34.1 11.6
0 0
```

Sample polygon file:

```
1 4
32.3 10.5
37.5 12.7
34.1 11.6
32.3 10.5
0 0
```

File Open Erdas Image
File Retrieve Erdas Image

Purpose
Display an ERDAS 7.4 LAN or GIS image in a new window, or retrieve an ERDAS image into the currently active window.

Parameters
Erdas 7.4 LAN or GIS file
Red band (for LAN images)
Green band (for LAN images)
Blue band (for LAN images)
Image X1 (default=0)
Image Y1 (default=0)
Image X2 (default=0)
Image Y2 (default=0)

Remarks
Use File Open Erdas Image to display an ERDAS image in a new window, or File Retrieve Erdas Image to display an ERDAS image in the currently active window.

The display must be capable of displaying at least 256 colors for these images to display properly.

Only 4- and 8-bit ERDAS images are currently supported.

If the image is in a geographic projection, maps can be overlayed on top of the image and the cursor can be used to display geographic coordinates.

When displaying GIS images, the colors are created from the Erdas trailer (TRL) file that is typically associated with the GIS file. If no trailer file is present, the color scheme defaults to 256 gray shades. When displaying single-band LAN images, or a single band of a multi-band LAN image, that band is displayed using 256 gray shades. The image values are stretched from the mean +/- 2 standard deviations to the range of 0 to 255. The mean and standard deviation are extracted from the STA file that is typically associated with LAN images. If this file does not exist, then the scaling is 1:1.

When displaying multi-band LAN images, one band is assigned to each of the red, green and blue colors. The image values for each band are stretched from the mean +/- 2 standard deviations to the range of 0 to 5 for the color assigned to that band. The result values are added together to create a final result between 0 and 215 according to the formula red + green*6 + blue*36. These values are

displayed in color with 6 intensities per color for a total of 6*6*6=26 possible colors. This technique is based on a similar algorithm implemented by the Idrisi system.

The image X1, Y1, X2 and Y2 can be used to display a window within the image. The zoom and pan functions will work with these images. The cursor will return screen and image coordinates. If projection information is present in the image header then the cursor will return geographic coordinates and maps can be overlayed on top of the image.

See Process Import Erdas Image and Process Export Erdas Image for more information on importing and exporting ERDAS images.

File Open ArcInfo Gen
File Retrieve ArcInfo Gen

Purpose
Display an ArcInfo GEN arc or point map in a new window, retrieve a GEN map into the currently active window, or overlay a GEN map on top of an image, bitmap or map in the currently active window.

Parameters
ArcInfo Gen file
Line color
Line style

Remarks
Use File Open ArcInfo Gen to display a GEN map in a new window. Use File Retrieve ArcInfo Gen to either retrieve a GEN map into the currently active window or to overlay a GEN map on top of an image, bitmap or map in the currently active window.

ESRI has developed a simple ASCII file format for arcs and points that can be "generated" to create ArcInfo coverages. These files can be created with ArcInfo by "ungenerating" coverages. WinDisp 4.0 can display these maps in a new window, or can overlay the maps on top of images or other maps with. To overlay Shapes on WinDisp 4.0 images, the coordinates should be in the long/lat projection. Note that the GEN format does not support polygons. Furthermore, WinDisp 4.0 does not support the display of GEN grids or annotation.

The format for arcs is:

```
101
2,3
4,3
4,6
END
102
2,1
3,2
END
END
```

where 101 and 102 are IDS. The comma-separated values are x and y coordinates. Each arc must end with END and the entire file must end with an additional END.

The format for points is:

```
301,2,4
302,5,6
303,1,1
END
```

where the first value on each line is an id, and the second and third are x and y values respectively. The file must end with END.

File Open ArcView Shape
File Retrieve ArcView Shape

Purpose
Display an ArcView SHP map in a new window, retrieve an ArcView SHP map into the currently active window, or overlay an ArcView SHP map on top of an image, bitmap or map.

Parameters
ArcView Shape file
Line color
Line style
Fill color
Fill style

Remarks
Use File Open ArcView Shape to display a shape map in a new window. Use File Retrieve ArcView Shape to either retrieve a shape map into the currently active window if it is empty, or to overlay a shape map on top of an image, bitmap or map in the currently active window if the shape map is in a lat/long projection.

ESRI has published a open format description for map features called Shapes that are often used with ArcView. ArcInfo coverages can be converted to Shape files with ArcView. Utilities are available to convert shape files to/from MapInfo MIF files.

WinDisp 4.0 can display Shape points, multi-points, lines, and polygons.

File New Project

Purpose
Open up a new, empty project window.

Parameters
[None]

Remarks
This is the first step in creating a project. See Projects for more information on creating projects.

File New Bitmap

Purpose
Open up a new, empty graphic window.

Parameters
[None]

Remarks
A new graphic window can be used for displaying bitmaps, images, maps, and any of the Draw features.

File New Text

Purpose
Open up a new, empty text window.

Parameters
[None]

Remarks
This is most often used for creating new text files, such as color tables.

File Close
File Close All

Purpose
Close the current window or all open windows.

Parameters
[None]

Remarks
This can be used to close the active window. The window can also be closed with the Close function in the windows control box in the upper-left corner of the window.

File Save Project

Purpose
Save the current project window to a project file.

Parameters
Filename to save to

Remarks
This is used to save all of the feature layers in a new or edited project. See Projects for a description of how to create and edit projects.

File Save Bitmap

Purpose
Save the current graphic window to a .bmp file.

Parameters
Filename to save to
JPEG Compression (2-255)

Remarks
This is used to save a project, image, map, bitmap or graphics window to a file in a variety of formats, including .BMP, .EPS, .JPG, .PCX, .RAS, .TGA, .TIF, .WMF, .WPG. Currently, .GIF format bitmaps are not supported because we do not have a license from Unisys.

If the window is saved in .JPG format, a compression factor from 2 to 255 should be specified, with 2 meaning no compression and 255 meaning maximum compression.

File Save Text

Purpose
Save the current text window to an ASCII text file.

Parameters
Filename to save to

Remarks
Be sure to save a text file after you have edited it.

File Print Current Window

Purpose
Print the current text or graphic window.

Parameters
Print width (inches)

Remarks
Prints the contents of the active window to the default printer. The image is automatically centered on the page, with left-right and top-bottom margins being equal. The height of the image is automatically derived from the width parameter by keeping the aspect ratio 1:1.

To change the default printer, use File Print Setup.

To print all open windows at once, use File Print All Windows.

File Print All Windows

Purpose
Print all WinDisp windows.

Parameters
Width of printed image, in inches.

Remarks
This function prints the contents of every window in WinDisp to a single page. The individual images are placed on the printer page as they are arranged in the main WinDisp window. There is no space between the windows, and the windows are seperated by a black line. As with File Print Current Window, the image is automatically centered on the page. Note that the height of the printed image is computed from the width given, since the aspect ratio of the image is kept at 1:1.

To change the default printer, use File Print Setup.
To print only the currently active window, use File Print Current Window

File Print Setup

Purpose
Select a printer.

Parameters
[None]

Remarks
Brings up the windows printer dialog box. This function does not print anything--it only allows you to select the printer to print to. The printer you select becomes the default printer for the system.

File Run

Purpose
Run an external application.

Parameters
Application name (and parameters)

Remarks

This is included to allow the user to open another application from within WinDisp. This may be included as a layer in a Project in order to view an external file associated with the project. Command-line parameters (such as file names) can be included.

File Exit

Purpose
Exit WinDisp.

Parameters
[None]

Remarks
There is no warning, so make sure you mean it.

3.4. Edit menu

Edit Undo

Purpose
Undo the previous graphics operation.

Parameters
[None]

Remarks
When displaying images, maps and drawing graphics, each operation is saved in a list in the window that it is displayed in. Clicking Undo will cause the most recent operation to be removed from the list, the window cleared, and each of the remaing operations repeated. In this way, each displayed feature can be removed from the window in turn, from the most recent backwards.

Edit Cut

Purpose
Cut a portion of a graphic or text to the clipboard.

Parameters
[None]

Remarks
The short-cut for this is ctrl-X. For text, the highlighted text will be cut and placed in the clipboard for later pasting. For graphics, use the cursor to select the region to be cut. Click once to select one corner of the region, and click again to select the other corner. The graphics will be cut and placed in the clipboard for pasting.

Edit Copy

Purpose
Copy a portion of a graphic or text to the clipboard.

Parameters
[None]

Remarks
The short-cut for this is ctrl-C. For text, the highlighted text will be placed in the clipboard for later pasting. For graphics, use the cursor to select the region to be copied. Click once to select one

corner of the region, and click again to select the other corner. The graphics will be placed in the clipboard for pasting.

Edit Paste

Purpose
Paste the contents of the clipboard to the current window.

Parameters
[None]

Remarks
The short-cut for this is ctrl-V. For text, any text in the clipboard will be placed in the text window at the location of the cursor. For graphics, a box will show the size of the graphic in the clipboard. Move the box to the desired location, and click once to place it there.

Edit Delete

Purpose
Delete a portion of a graphic or text.

Parameters
[None]

Remarks
Cut a region of a graphic, or selected text without placing it in the clipboard.

3.5. View menu

View Zoom In

Purpose
Zoom in on an image or bitmap in the current window.

Parameters
[None]

Remarks
Select a region of an image or bitmap with the cursor and zoom in on that region.

View Zoom Out

Purpose
Zoom out on an image or bitmap in the current window.

Parameters
[None]

Remarks
Select a point location on an image or bitmap and zoom out around that location. The current zoom factor is doubled.

View Zoom Previous

Purpose
Zoom to the previous image or bitmap coordinates.

Parameters
[None]

Remarks
If you have zoomed in or out on an image or bitmap, this will restore the image or bitmap to the previous coordinates. Note that this feature will only zoom back one level.

View Zoom Image

Purpose
Zoom back to original image or bitmap size.

Parameters
[None]

Remarks
This is a simple way to re-display the entire image or bitmap after zooming.

View Zoom Feature

Purpose
Zoom in on a selected map feature overlayed on an image or bitmap.

Parameters
[None]

Remarks
Select a feature on a map that is overlayed on an image and zoom in to that feature. If map coordinates have been specified for a bitmap, and a map has been overlayed, this feature can be used for zooming in on bitmaps as well.

View Zoom Lat/Long

Purpose
Zoom in on an image or bitmap to an area specified by latitude/longitude.

Parameters
Starting lat
Starting long
Ending lat
Ending long

Remarks
If you have a very specific region that you wish to display, and you know the lat/long coordinates of the region, you can specify them here and zoom an image to display only that location. If map coordinates have been specified when displaying a bitmap, this feature will work on bitmaps as well.

View Pan Up
View Pan Down
View Pan Left
View Pan Right

Purpose
Change the selected location within an image and redraw.

Parameters
[None]

Remarks
If the currently active window is displaying an image, these functions will change the image display parameters X1, Y1, X2 and Y2 to shift the image in the direction specified by 3/4 of the width or height of the image. The entire window will then be redrawn. These functions are not available from projects or batch files.

View Graph Image Series

Purpose
Graph time-series for selected pixels.

Parameters
List of image names

New!!!
In WinDisp 4.0 the graphs produced using this function can be saved as bitmaps using the File Save Bitmap function. Each image and/or map window can have an associated graph window and graphs can be annotated using the Draw menu functions.

Remarks
This function is used to display a graph of pixel values for a selected pixel in a series of images. The pixel to be graphed is selected with the cursor by clicking on the pixel in a previously displayed reference image.

The graph is displayed in the lower-right corner of the main window at the default window size set by Options Define Window Size, but can be moved, resized, or even tiled with Window Tile Vertically or Window Tile Horizontally.

The y-axis range is determined by the cumulative range of values for the selected pixels and grows as that range of values grows.

The series of images are extracted from a file-name list file. Multiple curves can be displayed by creating several columns of image names in the list file (up to 15 columns). This can be used to compare the current year to previous years, or a series of average images. The row names in the first column of the list file are used as x-axis labels. If a given image does not exist, that value for that image is skipped over. Therefore, it is okay to create a complete list of image names even before all of the images exist, therefore eliminating the need to re-create the image list every time a new image is added. See File-name list files for more information on how to create a list of image files for this function.

View Graph Map Data

Purpose
Graph tabular data for map features.

Parameters
List of stats tables

New!!!
In WinDisp 4.0 the graphs produced using this function can be saved as bitmaps using the File Save Bitmap function. Each image and/or map window can have an associated graph window and graphs can be annotated using the Draw menu functions.

Remarks
This function is used to display a graph of data values from a table where the first column of the data table contains names of map features that match the feature names in a map that has already been displayed. If image statistics for map features have been extracted with Process Stats, the resulting tables can be viewed with File Open Table and graphed with this function. To select a row from the table(s) to graph, click on a map feature on a previously displayed map. The row(s) in the table(s) with the same row name as the selected feature name will be graphed. Multiple curves can be graphed from multiple tables as specified in the list of table names.

The graph is displayed in the lower-right corner of the main window at the default window size set by Options Define Window Size, but can be moved, resized, or even tiled with Window Tile Vertically or Window Tile Horizontally.

The tables should be quote/comma-delimited ASCII files with field names in the first row and row names in the first column that match map feature names. The y-axis range is determined by the range of all values in the listed tables.

The series of tables are extracted from a file-name list file. Multiple curves can be displayed by creating several rows of table names in the list file (up to 15 rows). The row names in the first column will be used as curve labels in the graph legend. See File-name list files (§ 2.7.1.) for more information on how to create a list of stats tables for this function.

View Graph Histogram

Purpose
Graph the histogram of image pixel values.

Parameters
Image file
Difference image file

New!!!
In WinDisp 4.0 the graphs produced using this function can be saved as bitmaps using the File Save Bitmap function. Each image and/or map window can have an associated graph window and graphs can be annotated using the Draw menu functions.

Remarks
This is a simple utility for displaying a bar-graph of the number of pixels in each of the 256 possible pixel counts with an image, or in the difference between 2 images.

View Redraw

Purpose
Redraw the current window.

Parameters
[None]

Remarks
All layers displayed in the active window will be redrawn. This is most often used when the size of the active window is changed. The zoom factor of any images or maps will be re-calculated so that they still fit the window.

3.6. Draw menu

Draw Point

Purpose
Draw one or more points in the current graphic window.

Parameters
Point color
Point size
Point symbol
Coordinates (or use cursor)

Remarks
Comma-separated window coordinates can be included to place one or more points at a specific location in a graphics window. Coordinates must be specified when including this as a layer in a project.

Click once to place a point. Double-click to place the last point and exit the function.

Draw Line

Purpose
Draw a line in the current graphic window.

Parameters
Line color
Line style
Coordinates (or use cursor)

Remarks
Comma-separated window coordinates can be included to place lines at a specific location in a graphics window. Coordinates must be specified when including this as a layer in a project.

Click once to mark an end-point. Double-click to place the last end-point and exit the function.

Draw Region

Purpose
Draw a polygon in the current graphic window.

Parameters
Line color
Line style
Coordinates (or use cursor)

Remarks
Comma-separated window coordinates can be included to place polygons at a specific location in a graphics window. Coordinates must be specified when including this as a layer in a project.

Click once to mark an end-point. Double-click to place the last end-point, close the polygon and exit the function.

Draw Box

Purpose
Draw a rectangle in the current graphic window.

Parameters
Line color
Line style
Fill color
Fill style
Coordinates (or use cursor)

Remarks
Comma-separated window coordinates can be included to place a box at a specific location in a graphics window. Coordinates must be specified when including this as a layer in a project.

Click once to mark the first end-point. Double-click to place the last end-point and exit the function.

Draw Text

Purpose
Place text in the current graphic window.

Parameters
Text font
Text color
Text string
Coordinates (or use cursor)

Remarks
Comma-separated window coordinates can be included to place text at a specific location in a graphics window. Coordinates must be specified when including this as a layer in a project.

The cursor marks the upper-left corner of the text. A box shows the size of the text. Click once to place the text and exit the function.

Draw Fill

Purpose
Fill a polygon in the current graphic window.

Parameters
Line color to fill to
Fill color
Fill style
Coordinates (or use cursor)

Remarks
Comma-separated window coordinates can be included to start filling at a specific location in a graphics window.

Click once to begin filling. The region around the selected point will be filled outward until the line color or the edge of the window is reached.

Draw Labels

Purpose
Place map feature names on an image or map.

Parameters
Map file
Data file (optional)
Data field (optional)
Text font
Text color

Remarks
Typically, the features in a map file will have names. This function will display these names at the centroids of the features. Alternatively, you can specify a field in a quote/comma-delimited ASCII table where the feature names are in the first column, and the values in the selected field associated with the map features will be displayed instead.

Draw Legend From Existing File

Purpose
Draw a legend using a color table, or using the parameters specified in a legend file.

Parameters
Color table or legend file
Text font
Text color
Coordinates (or use cursor)

Remarks
A legend shows the colors used to display an image or mapped data. The colors are stored in a color table file, or in the case of map data, can be based upon the parameters specified in a legend file.

Legends are good for displaying colors either when the dataset contains few values or when only a few colors are assigned to ranges of values. If there are many colors in the color table, you may prefer to draw a colorbar with Draw Colorbar.

By default WinDisp 4.0 automatically displays legends to the right of an image or map. Many users may wish to either display no legend at all, or to place the legend in a different position. The default legend function can be turned in Options Display.

The legend can be positioned manually with the cursor, or automatically by including coordinates in the Options Dialog Box. The specified region is filled top to bottom and left to right. If the specified region is not high enough to fit all legend items in one column, then the remainder of the items will be placed in successive columns. In the extreme, you may have only one item per column, or a horizontal legend.

White space can be left around the edges of an image to make room to place the legend with Options Define Window Size.

Draw Legend Equal Intervals

Purpose
Draw a legend with equal intervals. This will based on the minimum and maximum data values in the map dataset unless the minimum and maximum values are otherwise specified by the user.

Parameters
Number of classes [2-255]
Minimum value
Maximum value
Color Scheme
Legend Range (1 Full or 2 Upper)
Text Font
Text Color
Coordinates (or use cursor)

Remarks
This function allow users to draw a legend associated with a map dataset with equal intervals based on the minimum and maximum data values in the map dataset, unless the minimum and maximum values are otherwise specified by the user.

The number of classes can be between 2 and 255 (default value = 10). The user can specify maximum and minimum values which are different from the actual map dataset maximum and minimum which are displayed when the users click on the command button [...], for these fields. If the user specified values are completely outside the actual data range, an error message will appear.

The options available for the color scheme are listed when the corresponding command button [...] is activated.

The legend class limits can be shown in FULL, indicating the upper and lower limits of the class (eg. 50 to 100), or UPPER, indicating the data are above the starting value for each class (eg. > 50).

Draw Legend Unique Values

Purpose
Draw a legend with one class for each actual data value.

Parameters
Color Scheme
Text Font
Text Color
Coordinates (or use cursor)

Remarks
This function allow users to draw a legend with one class for each actual data value. This can only be used with Integer values.

The options available for the color scheme are listed when the corresponding command button [...] is activated.

Draw Legend Percentiles / Draw Legend Quartiles

Purpose
Draw a legend using percentile classes or with quartile (4) intervals based on the minimum and maximum data values in the map dataset, unless the minimum and maximum values are otherwise specified by the user.

Parameters
Number of classes [2-100] - This option is not available in the Draw Legend Quartiles dialog box
Minimum value
Maximum value
Color Scheme

Legend Range (1 Full or 2 Upper)
Text Font
Text Color
Coordinates (or use cursor)

Remarks
This function allow users to draw a legend using percentile or quartile (4) classes. The number of categories must be between 2 and 100 (default value = 10) in the case of percentiles and automatically defaults to 4 for quartiles. The user can specify maximum and minimum values which are different from the actual map dataset maximum and minimum which are displayed when the users click on the command button [...], for these fields. If the user specified values are completely outside the actual data range, an error message will appear.

The options available for the color scheme are listed when the corresponding command button [...] is activated.

The legend class limits can be shown in FULL, indicating the upper and lower limits of the class (eg. 50 to 100), or UPPER, indicating the data are above the starting value for each class (eg. > 50).

Draw Legend Logarithmic

Purpose
Draw a legend with logarithmic intervals based on the minimum and maximum data values in the map dataset, unless the minimum and maximum values are otherwise specified by the user.

Parameters
Number of classes [2-255]
Minimum value
Maximum value
Color Scheme
Legend Range (1 Full or 2 Upper)
Text Font
Text Color
Coordinates (or use cursor)

Remarks
This function allow users to draw a legend with logarithmic intervals. The number of classes can be between 2 and 255 (default value = 10). The user can specify maximum and minimum values which are different from the actual map dataset maximum and minimum which are displayed when the users click on the command button [...], for these fields. If the user specified values are completely outside the actual data range, an error message will appear.

The options available for the color scheme are listed when the corresponding command button [...] is activated.

The legend class limits can be shown in FULL, indicating the upper and lower limits of the class (eg. 50 to 100), or UPPER, indicating the data are above the starting value for each class (eg. > 50).

Draw Colorbar

Purpose
Draw a bar showing continuous colors from color table.

Parameters
Color table
Text font

Text color
Minimum value (0-255)
Maximum value (0-255)
Coordinates (or use cursor)

Remarks
A colorbar is a useful way to show what colors are associated with which values in an image. The colorbar graphically depicts the range of image values over which a given color is used. If the image is classified, or contains discrete values, a legend may be more appropriate. Legends can be created with Draw Legend.

By default WinDisp 4.0 automatically displays legends to the right of an image or map. Many users may wish to either display no legend at all, or to place the legend or colorbar in a different position. The default legend function can be turned in Options Display.

The colorbar can be positioned manually with the cursor, or automatically by including coordinates in the Options Dialog Box. The specified region is filled with the colorbar. If the width is greater than the height, the colorbar is drawn horizontally, otherwise it is drawn vertically. The colorbar size and position matches the coordinates given. Any text from the Key field in the color table is drawn below a horizontal colorbar or to the right of a vertical colorbar and is therefore outside of the specified coordinates.

If the text is associated with a range of colors, the text is placed at the center of that range. To place text at the beginning of a range, add a row to the color table before the row containing that range. The From and To values should be set to the first value of the range, and the Key should contain the text you want to print. For example:

From	To	Red	Green	Blue	Key
0	0	0	255	255	First
0	81	0	255	255	
82	82	0	255	0	Second
82	254	0	255	0	
255	255	128	128	128	Water

White space can be left around the edges of an image to make room to place the colorbar with Options Define Window Size.

Draw Bitmap

Purpose
Display a bitmap at a specific location.

Parameters
Bitmap name
Coordinates (or use cursor)

Remarks
A bitmap is displayed starting at the coordinates supplied, or where the cursor is clicked. When moving a cursor, a box shows the size and location of the bitmap to be displayed.

Draw Map Point
Draw Map Line
Draw Map Region

Purpose
Digitize a point, line, or region (polygon) on-screen.

Parameters Draw Map Point
Map file
Point color
Point size
Point symbol
Primary feature name
Secondary feature name
Append if file exists (y/n)?
Coordinates (or use cursor)

Parameters Draw Map Line/Region
Map file
Line color
Line style
Primary feature name
Secondary feature name
Append if file exists (y/n)?
Coordinates (or use cursor)

Remarks
This function allows users to digitize points, lines and polygons on-screen over maps and images in a display window. The resulting map can be saved as a new .BNA map or appended to an existing .BNA map file containing the same features.

To digitize a single point, simply double click the left mouse button at the location you wish to digitize the point.

To digitize multiple points with the same primary and secondary feature names, single click all points at the correct location and save the feature as one cartographic object by double clicking the last point.

To digitize a line, start the line by clicking the left mouse button at the desired location, then continue clicking along the desired line feature, and finish digitizing the line by double clicking the left button at the last point on the line.

To digitize a polygon (region), proceed as for a line. The polygon will be closed when the last point is confirmed by double clicking the left mouse button.

Note: In order to precisely digitize points, line and/or polygons it is necessary to open an image and/or map file as a reference background.

The Append option allows users to add new features to an open or existing .BNA map file. Only one feature type can be contained in a single .BNA file therefore a file can ONLY consist of either points, lines or polygons and can not contain mixed features. Also, only like features can be appended to an existing or open file.

3.7. Batch menu

Batch processing is a powerful way to automate repetitive tasks. All of the main display and processing functions can be recorded in a batch file and then replayed at a later time. See Batch (§ 2.6.) for more information on batch processing.

Batch Record

Purpose
Record menu operations for later playback.

Parameters
Batch file name

Batch Play

Purpose
Play back previously recorded menu operations.

Parameters
Batch file name

Batch Debug

Purpose
Play back recorded batch file one line at a time.

Parameters
Batch file name

Batch Stop

Purpose
Stop recording or playing batch file.

Parameters
[None]

Batch Edit

Purpose
Edit a batch file in a text editor.

Parameters
Batch file name

Batch Variable

Purpose
Assign values to batch variables.

Parameters
Batch Variable Set
    Variable name
    Variable value

Batch Variable Prompt
    Variable name
    User prompt
    Default value (optional)

Remarks
Note that the variable value in Batch/Variable/Set can be an algebraic expression and can include other variables. See batch for a complete description of batch files and how to create and use them.

Batch If

Purpose
Include an if-then clause in a batch file.

Parameters
Batch If Begin
    Expression to evaluate
Batch If Else
Batch If End
    [None]

Batch For

Purpose
Include a for-next loop in a batch file.

Parameters
Batch For Begin
    Variable counter
    Loop start value
    Loop end value
    Step increment/decrement

Batch For End
    [None]

Batch Label

Purpose
Set up a goto jump and a label to go to in a batch file.

Parameters
Batch Label Goto
    Goto which label?

Batch Label Define
    Batch label name?

Batch Pause

Purpose
Temporarily halt execution of the batch file.

Parameters
[None]

Remarks
This command is used to let the user control the execution of the batch file. A message box will pop up telling the user that the batch file has been paused. Execution will continue after the OK button is pressed.

Batch Build List

Purpose
Build an image list for processing functions.

Parameters
File to save list in
List of files

Remarks
Many processing functions require the use of image lists for processing. These lists are saved in a "list file". This Batch Build List utility can be used to easily create such a list file from within a batch file. The first parameter is the name of the list file to save the filenames in and will be used for processing. The second parameter is a list of comma-separated filenames to be included in the list, along with column and row headings.

Sample filename list:

```
NDVI, 1996, Mean, Jan, dv9601.img, Feb, dv9602.img
```

3.8. Options menu

Options Display

Purpose
To set various display-related options.

Parameters
Show image and map legends
If yes, legends will be displayed to the right of the images and/or maps.

Show button bar
Show or hide the button bar at the top of the main window.

Show status bar
Show or hide the status bar at the bottom of the main window.

Show screen coordinates
If yes, display cursor screen coordinates for the active window in the status bar.

Show image coordinates
If yes, display cursor pixel/line coordinates for image in the active window.

Show geographic coordinates
If yes, display cursor long/lat coordinates for image in the active window.

Show image values
If yes, display image values for the pixel under the cursor for the image in the active window.

Show splash screen at startup
Don't bother to display the splash screen at startup. You can always get to the splash screen with Help About...

Options Project

Purpose
Set various options related to projects.

Parameters
Project width
Save Project settings

Remarks
Project width determines how wide the project window will be. If set here, project windows will be this size whenever they are opened for the remainder of the current session. If the value (y/n)vis saved with the Save Parameters button, then this width will be used in subsequent sessions as well.

If Save project settings is set to yes, then the value of each of the check boxes, plus any variables that have been assigned, will be saved in the project file when it is closed in the current session. If this value (y/n) is saved with the Save Parameters button, then the value will be the same for subsequent sessions as well.

Options Edit Color Table

Purpose
Create/Edit/Save a map or image color table.

Parameters
[None]

Remarks
This function calls up the Color Table Editor in a separate window. If a color table has already been selected by another function, that color table will be shown in the spreadsheet in this window. The menu options available for creating, editing and saving color tables are described below. Individual cells within the spreadsheet can be edited by first clicking on the desired cell, and then modifying the value therein. Clicking on a color cell will bring up a color selection tool that can be used to select one of the 16 basic EGA colors. Other colors are available by modifying any of the red, green or blue values.

See color tables for a more detailed description of color tables. The limitations on possible colors is important. See the IDA Users Manual for a description of IDA LUTs and palettes.

Note that a color table is a simple ASCII text file that can be edited in any text editor, including WinDisp 4.0.

Menu

File	
New	Create a new color table (specify the number of rows)
Open	Open an existing color table (specify a filename)
Save	Save the currently displayed color table to the current name
Save As	Save the currently displayed color table to a new name
Exit	Exit the color table editor and return to the main window
Rows	
Insert	Insert one or more rows above the selected row(s)
Append	Append rows to the end of the color table
Remove	Remove one or more selected rows
Define	Define exactly how many rows to create
Clear	Clear out all values in the selected rows
Ranges	
Images	
Equal Intervals	Create equal ranges based on image max/min
Equal Quantiles	Create ranges on equalized image histogram bins
Unique Values	Create row for each unique image value
Maps	
Equal Intervals	Create equal ranges based on data max/min
Unique Values	Create row for each unique data value
Percentages	Create a legend using 5, 10 or 20 percentile classes, based on max/min
Quartiles	Create a legend with quartile (4) intervals based max/min
Logarithmic	Create a legend with logarithmic intervals based on max/min
User-defined	
Equal Intervals	Create equal ranges based on user-defined max/min

Unique Values	Create unique values based on user-defined max/min
Clear	Clear values for all ranges and set to 0
Colors	
Black to White	Create a gradual shading of colors going from black to white, on all or on a selection of lines
White to Black	Create a gradual shading of colors going from white to black, on all or on a selection of lines
Red to Green	Create a gradation of colors going from red to green, on all or on a selection of lines
Red to Blue	Create a gradation of colors going from red to blue, on all or on a selection of lines
Red and Blue	Create a gradation of colors going from gradations of red to gradations of blue, on all or on a selection of lines
Bright Red and Blue	Create a gradation of colors going from gradations of bright red through gradations of blue, on all or on a selection of lines
Blue to Green to Red	Create a gradation of colors going from blue through green to red on all or on a selection of lines
Mixed Palette	Create a series of mixed colors based on the 16 EGA color scheme on all or on a selection of lines
Clear	Clear all colors and set to 0, 0, 0 (black), on all or on a selection of lines
Help	Call this help file

Options Edit Legend File

Purpose
Create / Edit / Save a legend file.

Parameters
Legend Type
Nr of Categories
Color Scheme
Legend Range
Legend Title (optional)
Data Min (optional)
Data Max (optional)
Text color (optional)
Font (optional)

Remarks
This function open the legend file editor dialog box. The menu options are described below.

The sub-menus for this function allow the user to select the type of legend, the color scheme, and the desired class limits, as well as the number of classes to use (options vary by legend type). If an incorrect or blank value is entered WinDisp 4.0 will use the default values.

Menu

File	
New	Create a new legend file
Open	Open an existing legend file (specifying path and file name)
Save	Save the legend file with the existing name
Save As	Save the legend file with a new name
Exit	Exit the Edit File legend menu and return to the main menu
Help	Open the help file dealing with legend files

Options Define Window Size

Purpose
Define a default sub-window size (or maximize).

Parameters
Maximize window (Y or N)?
Default width
Default height

Remarks
If you are always displaying images or maps of the same area, you can use this command to tailor the size of the window to fit your area of interest. If you save these parameters to the .INI file then they will be used each time you use WinDisp.

You can specify the number of pixels to leave blank with this function in order to specify a blank margin around your image and/or map area. Image and maps will only be displayed within the areas bound by the specified margins.

Options Communications

Purpose
File-based communications link to other program.

Parameters
Input directory
Output directory
Interval (milliseconds)

Remarks
This option can be used to establish a file-based communications link to another program. This was developed so that a Web server can call WinDisp 4.0 and request it to display images and maps and return a GIF bitmap of the result.

The communications process is as follows:
1. The calling function places a file with a .lck extension in the input directory.
2. The calling function places a file with a .req extension in the input directory. This file should be a batch file that WinDisp 4.0 is to execute.
3. The calling function removes the .lck file thereby signifying that the .req file should be processed.
4. WinDisp 4.0 creates a .lck file in the output directory.
5. WinDisp 4.0 opens and executes the .req batch file creating any requested outputs.
6. WinDisp 4.0 closes the .req file in the input directory, deletes it, and deletes the .lck file in the output directory signifying that it has completed execution.

The Interval parameter specifies how often WinDisp 4.0 should poll the input directory to check for .lck and .req files.

3.9. Process menu

Process Series

Purpose
Image time-series statistics for each pixel in the images.

Parameters
File list of image names
Image to create

Remarks
The following is a list of the time series statistics that can be calculated.

Max	Maximum value
Min	Minimum value
Avg	Average value
Median	Median value
Range	Range of values
Sum	Sum of values
Count	Number of valid pixels
Stddev	Standard deviation of values
Decloud	Temporal smoothing technique
Slope	Slope of trend-line of values
MaxDate	When the maximum value occurs
MinDate	When the minimum value occurs

Some of these functions require additional parameters as well.

See File-name list files for more information (§ 2.7.1.) on how to create a list of image names for this function.

Process Images Algebra

Purpose
Pixel algebra on one or more images.

Parameters
Equation
Image to create

Remarks
If the commands available in Process/Images and Process/Series aren't sufficient for your needs, you can write your own algebraic expression evaluate on a pixel-by-pixel basis on series of images.

This function is used to perform simple algebraic and logic functions on any number of images. It was originally created for applying correction factors to NDVI images. However, there are many other applications. For instance,

@IF(File1>82,File1,2)

where File1 is an NDVI image will mask all water features and assign them to pixel count 2.

The result of a logical operation is 1 (TRUE) or 0 (FALSE). The logical operators are as follows:

>	greater than
<	less than
=	equal to
>=	greater than or equal to
<=	less than or equal to
&	and
|	or
<>	not equal to

A Equation can be any mix of variables, numbers, and operators (+, -, *, /). Numbers can be any valid integer or floating point number (ie 3.059). Variables must begin with a letter or underscore, but the rest of the variable can contain a mix of numbers, letters, or underscores. Some examples:

VARIABLES	NUMBERS
Image_1	30
month	32.083
_01234_	.000009

Once a equation has been input, WinDisp will find all the possible variable names and prompt you for a filename to tie to the variable. Note that any variable can occur as many times as you wish.

Algebra will also do string comparison. Anything placed in quotes (") Algebra will assume is a string. This can be useful in a batch file where the user may want to fix pixel results for a certain file

Example line from a batch file:

```
@if("%foo%"="badimage.img", 0, (This_File+Some_File)/2)
```

would find the average of This_File and Some_File if the value of the batch variable Foo is not Badimage.img.

Process Images Compress

Purpose
Compress images to reduce overall size.

Parameters
Image to compress
Image to create
Compression factor

Remarks
This technique uses a simplified nearest-neighbor resampling technique to reduce the overall size of an image. Compression factors must be POSITIVE INTEGER values. Basically, the output image will retain every second (or third, fourth, etc.) pixel and line from the input image.

Process Images Window

Purpose
Extract a window out of an image.

Parameters
Image to window
Image to create
X1 of window (default=0)
Y1 of window (default=0)
X2 of window (default=0)
Y2 of window (default=0)

Remarks
This function is used to extract a portion of a larger image. For example, a window of data covering just Burkina Faso can be extracted from an image covering all of Africa. This reduces the amount of data stored on an analyst's computer.

Process Images Filter

Purpose
Max, Min, or average spatial filter for smoothing.

Parameters
Image to filter
Image to create
Filter width (1, 3, 5, 7, 9)
Max(1), Min(2), Avg(3), Median(4)?

Remarks
Satellite images are inherently "noisy" or "busy". A "smooth" image may be simpler to understand and explain. Images may be smoothed before being printed. A noisy image may be smoothed before a raster-to-vector conversion.

The filter implemented here is a simple averaging filter. For each pixel in the output image, the average of the corresponding pixel in the input image and all of its neighbors is calculated. The number of neighbors to include is determined by the filter width. A filter width of 3 will include the pixel and its eight nearest neighbors defined by a 3x3 pixel box around the pixel.

In the case of "classified" images, in which a pixel value represent a class, a median filter should be the only one used to maintain the spatial integrity and validity of each class in the filtered image.

Process Images Difference

Purpose
Subtract one image from another.

Parameters
First image (A-B)
Second image (A-B)
Image to create

Remarks
Sutracting one image from another is a very useful way to compare two images. For instance, you can compare current vegetation conditions with previous conditions. This function subtracts the second image from the first image and rescales the result to fit in 8-bits (0-255) according to the equation (256+A-B)/2. In the output image, if count = 128 there is no difference, if count > 128 then the first image has a higher value than the second image, and vice versa.

For quick visual comparisons, File Open Image to display difference images on-the-fly.

Process Images New

Purpose
Create a new, blank image.

Parameters
New image to create
Width of image
Height of image
Base value (0-255)

Remarks
New allows the user to create a new image and specify the initial size and base value. This command is used to create a blank image for Process Images Paste and Process Images Map.

Base value is the value you want all the pixels of the new image to be initialized to. Height and Width of image are the height and width in pixels you want the image to be. If you wish to set projection and value-scaling information to the image, use Process Header Edit or Process Header Change Value.

Process Images Paste

Purpose
Paste one image on top of another.

Parameters
Image to paste
Existing image to paste into

Remarks
If you have several small images over different areas that you wish to combine into a large image, you can use Paste. First create a blank image of the total area with Process Images New and edit the header as appropriate with Process Header Edit or Process Header Change Value to set the projection parameters. Make sure that the sub-images will fall entirely within the larger image. Then run paste to paste the smaller images on top of the larger image.

Process Images Map

Purpose
Fill image pixels within map polygon boundaries.

Parameters
Map file
Existing image to paste map into

Remarks
Map can be used to fill polygons on an image based on a map file. If the primary labels in the map file are numbers between 0 and 255, then the polygon will be filled with that value; otherwise, they will be filled with 255. This is essentially a vector to raster conversion. First create a blank image of the total area with Process Images New and edit the header as appropriate with Process Header Edit to set the projection parameters. Alternatively, you can also paste a map into an existing image, or "zero-out" an image in Process Images Algebra with an equation like image*0.

Process Images Mosaic

Purpose
Combine a series of images into a single image.

Parameters
File list of image names
Image to create

Remarks
Join two or more images into a single image. Images must have valid projection information in the image headers. The first image in the series must be the northern-most and western-most image in the series.

See File-name list files for more information (§ 2.7.1.) on how to create a list of image names for this function.

Process Stats

Purpose
Extract statistics from images for map features.

Parameters
List of image names
Map file
Stats file for results
Window around points (1, 3, 5, 7, 9)

New!!!
Statistics can now also be extracted using ESRI Shape files in addition to .BNA map files.

This function now save statistics in a slightly modified file format. The first row now contains field names derived from the first column of the image-names list. Existing stats files will be modified to fit this new format if additional stats are added to the file.

Remarks
The stats functions are used to extract and plot statistics derived from points and polygons within images. The extracted statistics may be imported into spreadsheets and databases to further analyze, model and plot.

Available statistics include:

Max	Maximum value
Min	Minimum value
Avg	Average value
Median	Median value
Stddev	Standard deviation of values
Range	Range of values
Count	Number of pixels in a polygon within thresholds

For a series of points or polygons, spatial statistics for those features are extracted from a series of images and the results stored in a tabular ASCII file. The points and polygons are read in from a map file. All images in the series should have the same header window and projection parameters because the map masks (pixels to extract statistics from) are only calculated for the first image.

See File-name list files for more information on how to create a list of image names for this function.

The stats file stores the results in quote/comma-delimited ASCII format, one map feature per line, statistics from one image per column. The first row contains field names that are derived from the first column in each row of the file list. Each row starts with the feature name derived from the map file, followed by one value from each image in the file list. Up to 36 statistics (up to 255 characters total) can be stored on one line.

The extracted statistics can be viewed with any ASCII editor, spreadsheet or database application, or with the internal viewer available from File Open Table. The values from a specific column can be used to shade a map with File Open Map or File Retrieve Map. The values can be overlayed on a map with Draw Labels. Time-series graphs can be drawn with View Graph Map Data.

By default, if more than half of the polygon contains pixels outside the relevant thresholds, a value of -9999 is returned. Both the thresholds and the percentage of the polygon that needs to be valid can be modified with the Process Thresholds command.

Process Header Edit

Purpose
View/Edit an image header.

Parameters
Image file

Remarks
Each image file begins with a 512 byte header containing information on the image, including the image size, projection parameters and optional value-scaling parameters. This command is used to look at the contents of the header and to modify them if desired. See Image headers (§ 4.1.2.) for a detailed description of the header parameters.

See Process Header Change Value for information on how to modify a single image header value.
See Image headers for a detailed description of the header parameters.

Process Header Change Value

Purpose
Change a single value in an image header.

Parameters
Image file
Variable name
Variable value

Remarks
This function can be used to change a single variable in an image header. For instance, after processing an image, you may wish to modify the header to reflect the results of the processing.

Use Process Header Edit to view and edit all header values.
See Image headers for a detailed description of the header parameters.

The following is a list of valid variable names (see § 4.1.2. for a detailled description) :

title
image_type
projection
height
width
lat_center
long_center
x_center
y_center
dx
dy
parallel1
parallel2
lower
upper
missing
m
b
decimals

Process Threshold

Purpose
Set upper and lower threshold for valid image values.

Parameters
Lower threshold (0-255)
Upper threshold (0-255)
% of pixels in polygon [50]

Remarks
Thresholds are used by all Process Images Algebra, Process Images Filter, Process Series and Process Stats functions to determine which pixel counts are valid to include in processing.

In a generic image, all possible pixel counts (0-255) are included in the processing functions grouped under the processing menu. For other image types, certain pixel counts are excluded from certain functions. In FEWS NDVI images, for instance, use counts 0 and 1 to store cloud masks, so the thresholds are set automatically to 2-255. The cloud pixels are excluded during processing.

IDA automatically sets default thresholds for each image type prior to processing. If the thresholds set by the THRESHOLD function are 0-0, then the defaults are used, otherwise the user-defined thresholds are used.

WARNING: Once the thresholds are set, they will be used throughout the rest of the current WinDisp session. If the thresholds are saved to the ini file, then they will be used in all successive WinDisp sessions as well. As a precaution, the thresholds should always be reset to 0-0 after processing.

When filtering a FEWS NDVI image, the user may wish to smooth only the land surfaces to avoid averaging coastlines and water together. To do this, set the thresholds to 82-255. 82 is derived from the equation COUNT = (NDVI*256)+82.

If the image type is CALCULATED, then the user can specify these values in the image header with Process Header Edit or Process Header Change Value.

The "% of pixels in polygon" parameter is used when extracting statistics with Process Stats. Statistics for a given feature are only extracted if the specified percentage of pixels within that feature fall within the specified thresholds. For instance, if thresholds are set to ignore clouds, and over 50% of a polygon is covered with clouds, then the statistic will not be calculated and a -9999 will be returned.

Process SEDI Automatic

Purpose
Automatically calculate interpolated image.

Parameters
Directory for temporary files
Input SURFER data file
Background image
Positive or negative relationship (P / N)
Number of pixels extracted per station (1, 5, 9, 13)
Delimiter of input SURFER data file
Missing value in input file

Distance between gridlines (kilometers)
Search radius for interpolation (kilometers)
Number of nearest stations to use
Output image file
Image type
Slope
Intercept

Remarks
This function automatically calculates all three SEDI steps. Note that two separate commands are created when recording a batch file. Both commands must be included in the order they are created. The commands are:
Process SEDI Automatic A
Process SEDI Automatic B

Process SEDI Assisted

Purpose
Automatically calculate interpolated image using parameter defaults.

Parameters
Directory for temporary files
Input SURFER data file
Background image
Output image file
Missing value in input file

Remarks
This function automatically calculates all three SEDI steps using defaults for most parameters. The defaults are stored in a file called assist.ini which is displayed after processing has completed. The values in assist.ini can be modified and the process repeated with these new values.

Process SEDI Step 1. Ratio File

Purpose
Calculate pixel / parameter ratios.

Parameters
Input SURFER data file
Output SURFER data file
Background image
Positive or negative relationship (P / N)
Number of pixels extracted per station (1, 5, 9, 13)
Delimiter of input SURFER data file
Missing value in input file
Keep missing data in output file (y/n)

Process SEDI Step 2. Grid

Purpose
Interpolate a Surfer grid file of ratios from the ratio file.

Parameters
Input SURFER data file (from step 1)
Output SURFER grid file
Background image
Distance between gridlines (kilometers)
Search radius for interpolation (kilometers)
Number of nearest stations to use
Missing value in input file

Process SEDI Step 3. Image

Purpose
Create an image of estimated values from gridded ratios and pixel values.

Parameters
Input SURFER grid file (from step 2)
Output image file
Background image
Positive or negative relationship (P / N)
Image type
Slope
Intercept

Process Import Ida Luts

Purpose
Convert IDA lookup table to WinDisp color table.

Parameters
Lut name
Pal name (optional)
Color table name

Remarks
IDA uses a file called a lookup-table, or LUT, for determining which of the 16 EGA colors to apply to which ranges of pixel counts when displaying an image. An IDA palette, or PAL, was used to modify those 16 colors. In WinDisp, the lookup-table, palette, and legend keys are all combined in an ASCII file called a color table. This command is used to convert IDA lookup tables into WinDisp color tables.

See Color tables for a description of what a color table consists of.

Process Import Ascii Image

Purpose
Import ASCII text file as an image.

Parameters
Ascii image to import
IDA image to create
Image width
Image height

Remarks
Several programs, such as IDRISI, can work with raster images in ASCII text format. Raster ASCII files are easily imported into spreadsheet programs as well. This function converts ASCII text files into IDA image files. The ASCII pixel values should be in the range 0-255. All pixels should be space delimited.

Process Import Binary Image

Purpose
Import raw binary 8-bit or 16-bit image.

Parameters
Raw 8-bit image to import
IDA image to create
Image width
Image height
Header size if exists on the input image.
Scaling factor to be applied to the 16 to 8-bit conversion.
The offset to be used for the 16 to 8-bit conversion
Swap bytes (in case of 16-bit images only)

Remarks
Many raster data files contain just raw data, in 1 byte (8-bit) or in integer (2 byte, 16-bit), without any attached header information.

This function will append raw, 8-bit or 16-bit, binary data onto an IDA image header so the data can be displayed and processed in IDA. If the raw data is padded to some convenient record length, or if ancillary data is attached to the beginning or end of the record, the "number of pixels" parameter should equal the entire length of the record, not just the length of the actual data in the record. If the header size is noted, the muber of bytes specified will be ignored by WinDisp when importing the file.

If the input file is greater than or equal to [(2 * height * width) + header size] then it assumed to be a 16-bit image and the last 3 parameters are used to convert the data to 8-bits per pixel. When importing 16-bit images, the correct slope and intercept (offset) values must be applied, if necessary, in order to scale the 16-bit file pixel values (which can range from -32767 to 32767) to the 8-bit 0 to 254 range.

Process Import Erdas Image

Purpose
Import Erdas 7.x LAN or GIS image.

Parameters
Erdas GIS or LAN to import
Image to create
Red band (for LAN images)
Green band (for LAN images)

Blue band (for LAN images)

Remarks
ERDAS is a widely used, robust, medium-sized image processing and raster GIS system, specializing in multispectral image analysis. The ERDAS 7.x image file formats have become something of a standard since they were adopted by ESRI for use in their ArcView system.

Only 4- and 8-bit images are currently supported.

A Platte-Carre (geographic) projection is assumed for all images being imported. If a different projection is used, Process Header Edit should be used to modify the image header accordingly.

See File Open Erdas for more information on displaying ERDAS images directly in WinDisp 4.0.

When importing single-band LAN images, a single band of a multi-band LAN image, or a GIS image, the values are imported as is, with no stretching.

When importing multi-band LAN images, one band is assigned to each of the red, green and blue colors. The image values for each band are stretched from the mean +/- 2 standard deviations to the range of 0 to 5 for the color assigned to that band. The result values are added together to create a final result between 0 and 215 according to the formula red + green*6 + blue*36. This technique was adopted from an algorithm used by Idrisi for the same purpose.

To display these multi-band LAN images correctly, you must use a special color table (called ERDASLAN.CLR) This color table has 6 intensities for red, green and blue for a total of 6*6*6=216 colors. The intensities are 0, 51, 102, 153, 204 and 255.
The start of the color table looks like this:

From	To	Red	Grn	Blu	Legend
0	0	0	0	0	
1	1	51	0	0	
2	2	102	0	0	
3	3	153	0	0	
4	4	204	0	0	
5	5	255	0	0	
6	6	0	51	0	
7	7	51	51	0	
8	8	102	51	0	
9	9	153	51	0	
10	10	204	51	0	
11	11	255	51	0	
12	12	0	102	0	
...					
215	215	255	255	255	

Process Import Erdas Trailer

Purpose
Convert an ERDAS 7.4 GIS trailer to a WinDisp color table.

Parameters
ERDAS GIS trailer file to import
Color table to create

Remarks
ERDAS stores the color scheme and histogram for GIS files in a separate file with the same name as the GIS file, but with the extension .TRL. This function will convert the color scheme in the trailer into a WinDisp 4.0 color table. The color table will contain 256 values, and should only be used when displaying images on a display capable of 256 colors.

Process Import Idrisi Image

Purpose
Import Idrisi image.

Parameters
Idrisi image to import
IDA image to create

Remarks
IDRISI is an inexpensive raster GIS developed by Ron Eastman at Clark University. IDRISI performs many useful GIS functions that complement IDAs functions well, such as zone generation, region aggregation, etc.

This function will only convert IDRISI 8-bit binary file formats.

A Platte-Carre (geographic) projection is assumed for all images being imported. If a different projection is used, the image header should be modified accordingly with Process Header Edit.

Process Import Idrisi Vector

Purpose
Import Idrisi vector map file.

Parameters
Idrisi vector file to import
IDA map to create

Remarks
IDRISI is an inexpensive raster GIS developed by Ron Eastman at Clark University. IDRISI performs many useful GIS functions that complement IDAs functions well, such as zone generation, region aggregation, etc.

Process Import Surfer Grid

Purpose
Import Surfer raster grid.

Parameters
Surfer grid to import
IDA image to create

Remarks
SURFER is a 3-D graphics package developed by Golden Software, Inc. SURFER can be used to plot contours and 3-D perspectives of images. SURFER's GRID functions can produce raster "image" files from point data such as meteorological and agricultural monitoring stations. The GRID functions also support robust mathematical operations similar to Process Images Algebra.

This function converts binary SURFER grid files into IDA images. The z-values in the grid file should be scaled to the range 0-255. The input image will have a generic IDA header attached and should be edited as necessary with Process Header Edit. Please note that if a raster grid was interpolated from point data in the SURFER/GRID function, that grid is in the geographic, or PLATTE-CARRE projection.

Process Import Surfer Plot

Purpose
Import Surfer plot file as bna map file.

Parameters
Surfer plot to import
IDA map to create
Length of longest side in inches

Remarks
SURFER is a 3-D graphics package developed by Golden Software, Inc. SURFER can be used to plot contours and 3-D perspectives of images. SURFER's GRID functions can produce raster "image" files from point data such as meteorological and agricultural monitoring stations. The GRID functions also support robust mathematical operations similar to Process Images Algebra.

SURFER can create HPGL plot files of its contours. These contours can be converted into bna map files and overlayed on images as such. A rough raster-to-vector conversion can be performed by converting an IDA image to a SURFER grid file, contouring it, plotting it, and converting the plot file into a map file.

To convert the plot file from plotter inches back into lat/long coordinates, this function needs to use the header parameters from the IDA image that had been converted to the SURFER grid file that was used to plot the contours. If the contours were not created from a converted image, a dummy image with a PLATTE-CARRE projection should be used.

This is, in fact, a very hokey function that should be used very carefully. ERDAS, IDRISI and ARC/INFO all provide much better raster-vector conversions.

Process Import ArcView Shape

Purpose
Import an ESRI ArcView Shape to .BNA format.

Parameters
ArcView Shape file
BNA map to create

Remarks
The "open GIS" format ESRI Shape files are now fully supported for all function in WinDisp 4.0 in the same fashion as the .BNA map files. This function allows users to convert Shape files to .BNA format if desired.

Process Export Ascii Image

Purpose
Export image to ASCII text file.

Parameters
IDA image to export
ASCII image to create

Remarks
Several programs, such as IDRISI, can work with raster images in ASCII text format. Raster ASCII files are easily imported into spreadsheet programs as well. This function converts IDA image files to ASCII text files. Each pixel is represented by a 3 character number in the range 0-255 seperated by a space. Each line of data is seperated by an end-of-line marker (<CR><LF>). If the ASCII file is to be

used with a program with a 256 characters/line limitation, the image file should be no more than 64 pixels wide.

Process Export Binary Image

Purpose
Export image to raw, binary 8-bit image.

Parameters
IDA image to export
Raw 8-bit image to create

Remarks
Many raster data files contain just raw data without any attached headers. Headers can be added or stripped off of 8-bit data with these functions.

This function merely creates an 8-bit binary data file without the IDA header.

When exporting an 8-bit image to another system, care must be taken to apply the correct scaling factors, if necessary, in order to maintain the correct values for the image. These parameters [slope (m) and intercept (b)] can often be obtained from the WinDisp image header using the Process Header Edit function. If specialized formats are being exported (i.e. ARTEMIS type 13), the scaling factors (m and b) for the different type of images supported by WinDisp 4.0 are provided in section 4.1.3 of this manual.

Process Export Erdas Image

Purpose
Export image to Erdas 7.x lan or gis.

Parameters
IDA image to export
ERDAS 7.x image to create

Remarks
ERDAS is a widely used, robust, medium-sized image processing and raster GIS system, specializing in multispectral image analysis. The ERDAS 7.x image file formats have become something of a standard since they were adopted by ESRI for use in their ArcView system.

The IDA images are converted to 8-bit ERDAS images. The extension should be either .LAN or .GIS. Internally, the file format for GIS and single-band LAN files are identical.

A Platte-Carre (geographic) projection is assumed for all images being exported. If a different projection is used, the ERDAS image header should be modified accordingly.

Process Export Idrisi Image

Purpose
Export image to Idrisi format.

Parameters
IDA image to export
Idrisi image to create (w/ext)

Remarks
IDRISI is an inexpensive raster GIS developed by Ron Eastman at Clark University. IDRISI performs many useful GIS functions that complement IDAs functions well, such as zone generation, region aggregation, etc.

This function creates IDRISI 8-bit binary files.

A Platte-Carre (geographic) projection is assumed for all images being exported. If a different projection is used, the Idrisi image header should be modified accordingly.

Process Export Idrisi Vector

Purpose
Export bna map to Idrisi vector map file.

Parameters
IDA map to export
Idrisi vector file to create

Remarks
IDRISI is an inexpensive raster GIS developed by Ron Eastman at Clark University. IDRISI performs many useful GIS functions that complement IDAs functions well, such as zone generation, region aggregation, etc.

Process Export Surfer Grid

Purpose
Export image to Surfer raster grid.

Parameters
IDA image to export
Surfer grid to create

Remarks
SURFER is a 3-D graphics package developed by Golden Software, Inc. SURFER can be used to plot contours and 3-D perspectives of images. SURFER's GRID functions can produce raster "image" files from point data such as meteorological and agricultural monitoring stations. The GRID functions also support robust mathematical operations similar to Process Images Algebra.

This function converts IDA images into binary Surfer grid files. If the IDA image type is generic, the z-values in the grid will be in the range of 0-255. For other image types, the z-value will be a function of that image type.

If the IDA projection type is Platte-Carre (geographic), then the projection information will be transferred to the grid file. Otherwise, the projection information is ignored.

Process Export Surfer Blank

Purpose
Export bna map file to a Surfer blanking file.

Parameters
IDA map to export
Surfer blanking file to create
IDA Image to be blanked

Remarks
SURFER is a 3-D graphics package developed by Golden Software, Inc. SURFER can be used to plot contours and 3-D perspectives of images. SURFER's GRID functions can produce raster "image" files from point data such as meteorological and agricultural monitoring stations. The GRID functions also support robust mathematical operations similar to Process Images Algebra.

SURFER has the capability to mask out, or "blank", all grid values inside or outside of a polygon. The line segments in the blanking file can also be overlayed on SURFER contour and surface plots in much the same way as maps are overlayed on images in WinDisp. This function converts bna map files into SURFER blanking files. The blanking file is specific to grid files created from images with the same window and projection parameters. These parameters are extracted from the reference image file header. All map features to be converted should lie ENTIRELY within the boundaries of the reference image.

Process Export ArcView Shape

Purpose
Export a .BNA map file to an ESRI Shape file.

Parameters
IDA map to export
ArcView Shape file

Remarks
The "open GIS" format ESRI Shape files are now fully supported for all function in WinDisp 4.0 in the same fashion as the .BNA map files. This function allows users to convert .BNA files to the Shape file format if desired.

Process Reproject

Purpose
Convert the projection of an image.

Parameters
Image to reproject
Reference image in output projection
New image to create

Remarks
This function can be used to convert an image from one projection to another. Because the projection parameters are stored in the image header, a sample image header with the correct output projection is used as a reference image. If you do not have an image in the correct projection, one can be created with Process Images New and then the appropriate parameters entered into the header with Process Header Edit. See Image headers for a list of supported projection types.

3.10. Window menu

Window Cascade

Purpose
Cascade all open windows.

Parameters
[None]

Remarks

This is a standard Windows feature that will resize all sub-windows to a standard size and organize them on the main window each one below and to the right of the previous one so that the titles of all of the sub-windows are visible.

Window Tile Horizontally

Purpose
Fit all open windows down the main window.

Parameters
[None]

Remarks
This is useful for displaying a series of images or maps side-by-side. You can either open each file in a new window, tile the windows, and then re-draw each window, or open a series of new windows, tile them and then retrieve the files into the windows.

Window Tile Vertically

Purpose
Fit all open windows across the main window.

Parameters
[None]

Remarks
This is useful for displaying a series of images or maps side-by-side. You can either open each file in a new window, tile the windows, and then re-draw each window, or open a series of new windows, tile them and then retrieve the files into the windows.

Window Arrange Icons

Purpose
Arrange all icons across the bottom of the main window.

Parameters
[None]

Remarks
This is a little-used function. However, it is useful if you have a whole bunch of windows open and minimized, and they are overlapped. Arrange them so that you can see each individual icon.

Window Select

Purpose
Select a window to make the current window.

Parameters
Number of window to select

Remarks
Each window displayed has a caption in it's title bar that begins with a number. Use that number in Window Select to make that window the active window for displaying files, etc. This function is most useful when combined with Window Define in a batch file for displaying an image time-series. Note that you can also make a window the active window by clicking anywhere on the window. You can also make the window active by selecting a window from the list shown in the Window menu.

Window Define

Purpose
Open and tile multiple windows within the main window.

Parameters
Number of windows across
Number of windows down

Remarks
Define and display a series of windows across and down. The windows are tiled to fit the main window. This function is useful for displaying image time-series for comparative analysis. Use Window Select to select an active window to retrieve files into. The File Print All function can be used to print all windows to the printer.

3.11. Help menu

Help Contents (F1)

Purpose
Open this help file.

Parameters
[None]

Remarks
To get help on a particular menu function, click on the Help button in the Options Dialog Box for that function, or press F1.

Help About

Purpose
Display version information, etc.

Parameters
[None]

4. File formats

4.1. Image files

WinDisp 4.0 uses images in the IDA (Image Display and Analysis) format. The IDA image file consists of a 512 byte image header followed by unblocked (raw binary) image data, 1 byte per pixel, beginning at the top-left of the image and processing row by row. This means that the size of an IDA image in bytes can be expressed as 512 + (lines*pixels).

An image that is 150 lines high and 234 pixels wide will have an image size of 35612 bytes. This provides an excellent check whenever images seem to be distorted. Some caution however is justified. A number of systems that generate IDA images leave some extra bytes at the end of an image. They do not influence the image display, but the image size does not adhere to the above mentioned formula.

4.1.1. Image header format

BYTE	CONTENTS	DATA TYPE
1-22	(reserved)	
23	image type	character
24	projection	character
25-30	(reserved)	
31-32	height	integer (2 bits)
33-34	width	integer (2 bits)
35-38	(reserved)	
39-118	title	80 characters
119-120	(reserved)	
121-126	lat_center	real 6 bits
127-132	long_center	real 6 bits
133-138	x_center	real 6 bits
139-144	y_centre	real 6 bits
145-150	dx	real 6 bits
151-156	dy	real 6 bits
157-162	parallel 1	real 6 bits
163-168	parallel 2	real 6 bits
169	lower limit	character
170	upper limit	character
171	missing value	character
172-177	slope (m)	real 6 bits
178-183	intercept (b)	real 6 bits
184	decimals	character
185-512	(reserved)	

The image values themselves are stored as bytes in the rest of the image file. The first byte of this block (offset 513) is the top-left most pixel of the image, followed by the rest of the first line. Line for line is then specified. The last byte represents the pixel value for the bottom-right most pixel in the image.

The following is the TURBO-PASCAL record type description for the image header record:

```
type   header_type  = record
reserved1 : array[1..22] of byte;
image_type : byte;
projection : byte;
reserved2 : array[25..30] of byte;
height  : integer;
width : integer;
reserved3 : array[ 35..38] of byte;
```

```
title : array[1..80] of char;
reserved4 : array[119..120] of byte;
lat_center : real;
long_center : real;
x_center : real;
y_center : real;
dx : real;
dy : real;
parallel1 : real;
parallel2 : real;
lower : byte;
upper : byte;
missing : byte;
m : real;
b : real;
decimals : byte;
reserved5 : array[185..512] of byte;
end;
```

4.1.2. Description of the image header items

height, width
These values define the number of pixels across and down the image. An image will not display properly without these parameters. Maximum value for either parameter is 32767.

title
The header reserves 80 characters for a description of the contents of the image. This is an optional feature.

reserved
All reserved slots are to maintain compatibility with the TERRAMAR MICROIMAGE file format. Programmers can use these zones to store information, when no compatibility with TERRAMAR is required.

image_type
WinDisp 4.0 now supports 17 different types of images. The image type is used when converting pixel counts into true values for NDVI. The image type also tells which pixel counts are for cloud masks, overlays, garbage, etc.

The following image types are defined:

GENERIC = 0
FEWS NDVI = 1
EROS NDVI = 6
ARTEMIS CUTOFF = 10
ARTEMIS RECODE = 11
ARTEMIS NDVI = 12
ARTEMIS FEWS = 13
ARTEMIS NEWNASA = 14
GENERIC DIFF = 100
FEWS NDVI DIFF = 101
EROS NDVI DIFF = 106
ARTEMIS CUTOFF DIFF = 110
ARTEMIS RECODE DIFF = 111
ARTEMIS NDVI DIFF = 112
ARTEMIS FEWS DIFF = 113
ARTEMIS NEWNASA DIFF = 114
CALCULATED = 200

This is always a linear relationship that can be expressed by:

value = slope * byte value + intercept, by analogy with the basis formula : y = mx + b.

For normal image processing, GENERIC is suggested.

projection

The projection information is used when overlaying maps on images, reprojecting images, and getting lat/long image co-ordinates with the cursor.

The following projections are implemented:

NONE = 0
HAMMER_AITOFF = 2
PLATTE_CARRE = 3 (Geographic lat/long)
LAMBERTCC = 4 (Lambert Conformal Conic)
METEOSAT = 5
LAMBERTAZ = 6 (Lambert Azimuthal)
ALBERS EQUAL-AREA CONIC = 8
GOODES HOMOLOSINE = 9

The values lat_center, long_center, x_center, y_center, dx, dy, parallel1 and parallel2 determine for a given image type the pixel size, the exact location on earth and the 'shape' of the image. To be more precise:

lat_center, long_center

These values identify the center of the projection in decimal degrees.

x_center, y_center

These values define the center of the image relative to the reference projection image. For the reference image, these values are 1/2 the height and width. For sub-images, the sub-image offsets are subtracted from the reference x_center, y_center.

dx, dy

These values are used by the projection routines when converting from longitude/latitude to line/pixel and vice versa. The values of dx and dy for the projections and image types supported in WinDisp 4.0 are as follows:

Geographic / Platte-Carre (Lat./Long.)
dx = degrees longitude / pixel
dy = degrees latitude / pixel

Hammer-Aitoff (for NASA NDVI images)
dx = 1 / (blowup * (width - 56) / 2)
dy = 1 / (aspect ratio * blowup * (height - 48) / 2)
These are (dx = 0.0004233844 and dy = 0.0008467687 for Africa)

Meteosat
dx = 18 / width
dy = 18 / height
(Spheroid: Eq. radius = 6,378,155m, Polar radius = 6,356,751.8m)

Lambert Conformal Conic
dx = nominal kilometres / pixel
dy = nominal kilometres / pixel
(Spheroid: Clarke 1866 - Eq. radius = 6,378,206.4m, Polar radius = 6,356,583.8m)

Lambert Azimuthal
dx = meters/pixel
dy = meters/pixel

(Spheroid: Sphere of radius 6,370,997 meters)

Albers Equal-Area Conic
dx = meters/pixel
dy = meters/pixel
(Spheroid: Clarke 1866 - Eq. radius = 6,378,206.4m, Polar radius = 6,356,583.8m)

Goodes Homolosine
dx = meters/pixel
dy = meters/pixel
(Spheroid: Sphere of radius 6,370,997 meters)

parallel1, parallel2
The standard parallels are used by the Lambert Conformal Conic projection, and Albers Equal-Area Conic.

lower
The lower limit for valid image data to be used in processing (range = 0-255). Only available for image type 200.

upper
The upper limit for valid image data to be used in processing (range = 0-255). Only available for image type 200.

missing
Value to assign to all values falling outside the lower, upper limits (range = 0-255). Only available for image type 200.

m
Slope for converting pixel counts to real-world values (y = mx + b). Only available for image type 200.

b
Intercept for converting pixel counts to real-world values (y = mx + b). Only available for image type 200.

decimal
The number of decimal places to use in Process Stats. Only available for image type 200.

Remark
For further information, please refer to the user manual 'IDA for DOS v.4.2 - Image display and analysis', FAO 1996 (SD:GCP/INT/578/NET Technical report).

4.1.3. Characteristics of the different type of images supported by WinDisp 4.0

	Bitsperpixel	lower	Upper	missing	m	b	decimals
GENERIC		0	255	0	1	0	0
NDVI		2	255	0	1/256	-82/256	2
EROS_NDVI		2	255	0	1/100	-100/100	2
CUTOFF		0	253	254	1	0	0
RECODE		0	253	254	4	0	1
ANDVI		0	253	254	4/500	-3/500 - 1	2
AFEWS		2	253	254	1/256	-82/256	2
NEWNASA		0	250	254	0.75/250	0	2
NDVI_DIFF		2	255	0	1/128	-1	3
EROS_DIFF		2	255	0	1/50	-128/50	3
CUTOFF_DIFF		0	253	254	2	-128*2	1

RECODE_DIFF		0	253	254	8	-128*8	2
ANDVI_DIFF		0	253	254	8/1000	-(128*8)/1000	3
AFEWS_DIFF		2	253	254	1/128	-1	3
NEWNASA_DIFF		0	250	254	0.75/125	-128*m	3
CALCULATED		*	*	*	*	*	*
DEFAULT	8	0	255	0	1	0	0

* user defined

4.2. Color tables

A colour table contains six tab-delimited fields. The first line describes the fields.

Here is an example:

From	To	Red	Green	Blue	Legend
0	5	255	255	255	Clouds
6	92	255	226	201	Bare Soil
93	110	255	211	150	
111	118	255	255	176	
119	127	211	255	125	Sparse Veg
128	137	201	255	201	
138	147	176	230	176	
148	158	140	211	140	Light Veg
159	168	100	176	100	
169	181	75	150	75	Medium Veg
182	195	50	125	50	
196	210	25	100	25	
211	254	0	75	0	Heavy Veg
255	255	128	128	128	Water

FROM and TO are the range of image values to be assigned to a color or data ranges for a map. For an image, these values must be in the range of 0-255 and correspond to the actual digital counts, not the derived values such as NDVI. The values should not overlap between colors. Also, the FROM value in a color should be one greater than the TO value in the previous color.

RED, GREEN and BLUE are the intensities of the respective primary colors in the range of 0-255.

LEGEND is an optional text field that will be displayed along-side the colors in the legend.

For further information concerning colortables, see § 2.4.5.

4.3. Legends

Legend files are used to store parameters used for the display of map data files and associated legends. They are ASCII files which can be modify directly in WinDisp 4.0 using the legend file editor.

An example of a legend file is as follows:

```
Type=1 Equal Intervals
NrOfCategories=10
ColorScheme=5 Red and Blue
LegRange=2 UPPER
LegTitle=Example
DataMin=
DataMax=
Font=/8/NoStrikeThru/NoUnderline/NoItalic/NoBold/
TextColor=0
```

Detailed information about legend files is provided in section § 2.4.6 of the user manual.

4.4. Maps

The map files used by WinDisp 4.0 are in the ATLAS*GIS export format. The file type supported are point, line and polygon. These files, unlike the IDA images format used by WinDisp 4.0, are in ASCII format and can be viewed and edit using a text editor.

The ASCII file consists of sequential lines of text with no spaces (except in the feature name). Each line ends with a carriage return. The first line for a feature contains one or two feature labels of up to 16 characters surrounded by double quotes, followed by a comma and then the number of points that describe the feature:

- For a point, the number is 1
- For a line, the number is -1 times the number of line segment endpoints in the feature
- For a polygon, the number is the number of endpoints +1. For a polygon, the last point is the same as the first point.

Each line following the feature name line should contain the longitude, comma, latitude for an endpoint in decimal degrees. After the last endpoint, a new feature may be started. Limitations are 1,100 endpoints per feature, 3,000 endpoints per file and 200 features per file. The following is an example of a map file with one point, one line and one polygon.

The following are the basic models of the formats required for the point, line and polygon files:

```
“point name 1”,“point name 2”,1
1.00,1.00
“line name 1”,“line name 2”,-3
1.00,1.00
1.00,2.00
2.00,3.00
“polygon name 1”,“polygon name 2 ”,5
1.00,1.00
1.00,2.00
2.00,2.00
2.00,1.00
1.00,1.00
```

The following city map for Burkina Faso is an example of a point file:

```
"Ouahigouya","Burkina Faso",1
-2.33,13.52
"Ouagadougou","Burkina Faso",1
-1.67,12.33
"Koudougou","Burkina Faso",1
-2.38,12.25
"Bobo-Dioulasso","Burkina Faso",1
-4.30,11.18
```

The following river map for Burkina Faso is an example of a line file:

```
"1","Perennial river",-6
 1.878,11.336
 1.908,11.384
 1.902,11.430
 1.887,11.436
 1.862,11.445
 1.804,11.439
"1","Perennial river",-84
 -2.081,14.007
 -2.068,13.707
 etc.
```

The following island (country) map for Cape Verde is an example of a polygon boundary file:

```
"Santa Lucia","",8
-24.73,16.74
-24.76,16.75
-24.80,16.78
-24.80,16.80
-24.77,16.80
-24.74,16.76
-24.71,16.76
-24.73,16.74
"São Nicolau","",19
-24.33,16.48
```

-24.35,16.49
etc.

The second label for a feature name is optional: it may or may not be there. While the first label normally denotes the name of the feature, the second one can be used to point to a larger geographic entity to which the region (polygon) or point belongs. However, the user is free to use both labels to his own liking.

4.5. Bitmaps

Several type of bitmaps can be displayed in WinDisp 4.0, including: .BMP, .EPS, .JPG, .PCX, .RAS, .TGA, .TIF, .WMF, .WPG. GIF type bitmaps can only be displayed if WinDisp 4.0 is installed with the additional *'Lead Tools'* drivers.

4.6. Text files

Text (ASCII) files can be displayed and edited in WinDisp or using any standard text editor.

4.7. Data tables

Data tables can be displayed in WinDisp as they relate to a corresponding map files of as an ASCII text file. Tables can be created and edited with any text editor.

The following is an example of a data file with 5 fields for Taro and Yams in Benin (note that -9999 used for Borgou Province is the no data available tag used by WinDisp 4.0):

Region,Total Prod. [000 MT],Per Cap. Prod. [kg],Yield [kg/ha],Area Harv./Region Area [pct],Area Harvested [ha]
Atakora,328.72,528.48,11038,0.95,29781
Atlantique,39.89,43.88,11801,1.05,3380
Borgou,-9999,-9999,-9999,-9999,-9999
Mono,116.09,190.31,12674,2.41,9160
Oueme,83.64,103.78,10352,1.72,8080
Zou,239.15,327.15,11399,1.12,20980

Information on how to display tabular data in a corresponding map file are contained in section § 2.4.4 of this manual.

4.8. Films

A film can be developed from using a series of bitmaps (.BMP) which can be displayed in rapid succession. A film is created by saving images using File Save Bitmap (if not already available) and then by creating a file list (see section § 2.7.1.) of bitmap file names in the order they are to be displayed. A list file is a simple comma separated value ASCII file. An example follows:

, A
1, s:\images\image1.bmp
2, s:\images\image2.bmp
3, s:\images\image3.bmp
4, s:\images\image4.bmp
5, s:\images\image5.bmp

4.9. Project files

Project files are text (ASCII) files can be displayed and edited in WinDisp or using any standard text editor.

Detailed information on the format, use and construction of project files can be found in section § 2.5 of this manual.